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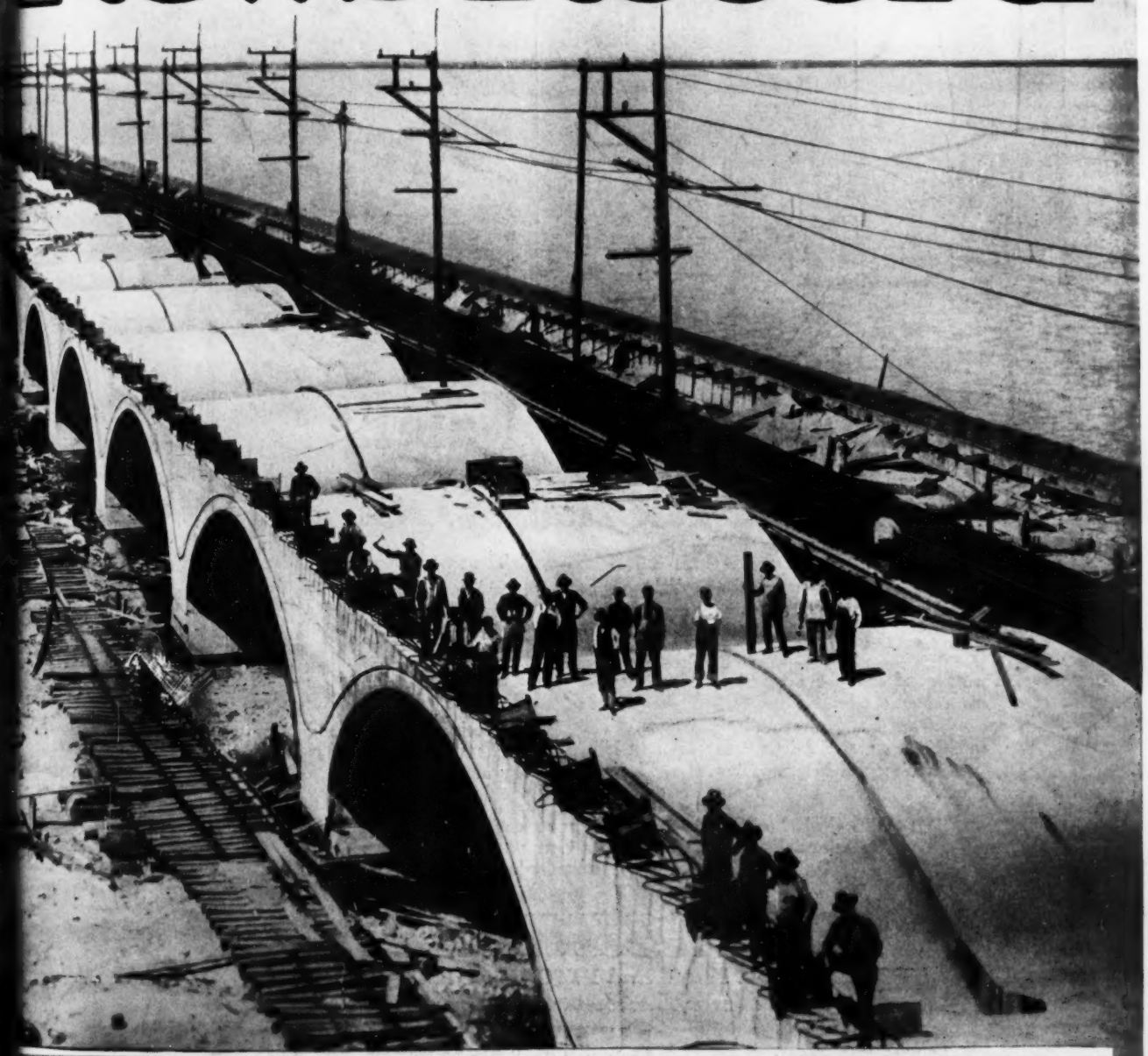
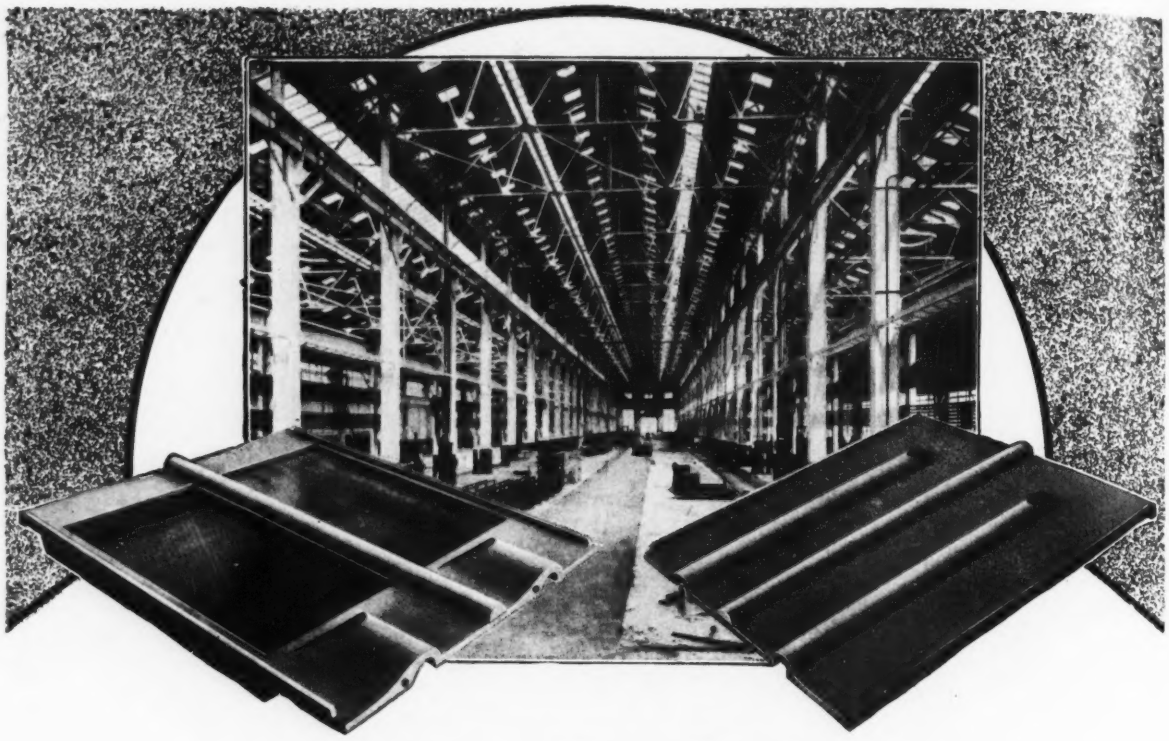


Report of American Water Works Association Annual Meeting

Function of Corporate Contract Bonds—How Obtained
By HARMON V. SWART

Surface Aggregate or Fineness Modulus For Concrete Mixes

Rebuilding Concrete Arch Section of Galveston Causeway, Using Old Sheet Piling to Form Cofferdam



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E. J. MEHREN, *Editor* — CHARLES WHITING BAKER, *Consulting Editor*

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The Development Committee Speaks

MUCH food for thought is contained in the progress report of the Development Committee of the American Society of Civil Engineers submitted at Minneapolis this week and printed on p. 1229. The many recommendations which the committee offers as a tentative outline of its final report deserve the earnest consideration and full discussion which the committee desires. If these are given, as we trust they will be, crystallization of opinion may be expected that will go far toward putting the society and the whole engineering profession where they belong among the forces of twentieth-century technical and civic progress.

Across the Atlantic

NOT because it is a matter of news to anyone who reads this, but because it is a record in transportation history, it should be set down that on June 14-15, with Capt. John Alcock, an Englishman, as pilot, and Lieut. A. W. Brown, an American, as navigator, a Vimy-Vickers biplane made the first nonstop flight across the Atlantic, a voyage of 1930 miles from Newfoundland to Ireland in 16 hours and 12 minutes. Adventure though it was, the flight marks one more step forward in air navigation, not only as it testifies to the solid engineering background of the plane and its engine, but because of the unerring direction through sleet and fog and starless night straight to the big wireless station on the Irish coast.

New Pumping Engine Promised

RECIPROCATING pumping engines have been so far displaced by rotating types of late that no little interest was created by Mr. Decrow's paper on the "Unaflow" pumping engine read at the Buffalo water-works convention last week (p. 1193). The interest was heightened and the hope for an early placing on the market of the new machine increased by the working unit seen in operation at the local water-works. Proposed tests of this 3,000,000-gal. unit will be awaited with interest.

Machines Instead of Laborers

DRUDGERY is becoming unpopular in the world. The hewers of wood and drawers of water are more scarce than they were before the war decimated their numbers and educated to less tiring and irksome labor many that were spared. In this country especially, the effect is clear. The increased cost of unskilled labor has far surpassed the universal increase in cost of all things. Mechanics' wages have gone up 30, 40, and in a few cases 100% over pre-war standards. Common labor today costs two and three times what it did five years ago, and in most construction work, particularly in heavy construction, common labor makes up the bulk of labor costs. What is to be done? The answer is obvious. Machinery to supplant unskilled labor must be provided. Too much of the inventiveness of mankind has been devoted to reproducing mechanically the skill of man. More must in the future go to relieve the drudgery, and in so doing to reduce the cost of production and of construction. If the material-handling machinery men who met in New York City last week can, through the joint effectiveness of their machines and their propaganda, spread this gospel, their reward will be commensurate with the great service rendered.

Buffalo Should Save Still More Water

MARKED has been the reduction of water waste in Buffalo by pitometer surveys and house-to-house inspection. There can be no doubt of the wisdom of continuing work along both lines, but do not Mr. Andrews' own statements (p. 1196), that the good results of house-to-house inspection seem likely to disappear in two or three years, indicate that at most only local conditions can justify the postponement of universal metering in Buffalo? True, the plan is to install meters where most needed. True, also, that in a city where consumption and waste once reached the enormous figure of 339 gal. per capita wholesale metering cannot be instituted over night. Time for educational leaven to work is often necessary in such cases. Mr. Andrews' educational bulletins (see *Engineering News-Record* of June 5, 1919, p. 1094) and the pressing need for reducing consumption so as to make filtration possible at a reasonable outlay, combined with the transient results from house-to-house inspection, will doubtless quicken Buffalo's speed in metering.

Labor Opposed to Radicalism

DURING the war there was constant fear that the socialistic element in the American Federation of Labor would get the upper hand. In fact, there were surprising demonstrations of its strength. It appears, however, from the convention of the federation in session last week in Atlantic City, that this element has either been very largely eliminated or, coming to its senses, has realized that true progress lies along the lines that the federation has pursued for many a year. At Atlantic City the determination has been clear to stamp out anything that savors of the revolutionary doctrine or action. Such assurance is encouraging at the present time, though anyone who has followed the federation's activities knew that it could be counted on to oppose radicalism if the Gompers element remained in power. The fact that the federation will oppose revolutionary doctrine and methods, however, is not assurance of speedy adjustment of the labor phase of our industrial problem. But it does warrant the hope that we can go about the task of stabilizing our industries without the fear that there will be lacking the coöperation of the strongest factor in the labor field.

Useless to Postpone Construction

THE consensus of opinion at the convention of the American Water Works Association in Buffalo last week was that the present high level of prices will continue, with little downward change, so it will be useless to postpone construction longer for the sake of less outlay. Prices of some materials may fall, but since labor cost is bound to keep up or even increase, and because labor enters so largely into water-works materials and construction, there seems no hope of any considerable reduction in water-works costs. The vital importance of water-works upkeep and extension, coupled with the fact that this is a revenue-producing utility, adds strength to the argument for going ahead with much-needed water-works operations.

Coöperative Course in Commercial Engineering

THE departure by Dean Herman Schneider at the University of Cincinnati in inaugurating, through the merged College of Engineering and Commerce, a co-operative course in commercial engineering, is an epoch-making venture. Judged from the standpoint of need for such a course, which was announced in our news pages last week, its success can be predicated beforehand—business men have been clamoring for applied scientists who could also think in terms of commercial values. And while courses in which engineering and business training have been combined already exist in various institutions, this is the first in which the co-operative system is applied. With the great advantages of first-hand contact with commercial problems such as results from the coöperative principle, the effectiveness of the new course, especially in the experienced hands of Dean Schneider, can be assumed from the start. It seems not unlikely that this new departure will mean a slowly developing element in the profession which should help mightily in raising its status in the business world.

Building Activity and Mortgages

COMPLAINT has been general that the revival of building construction has been delayed because of the difficulty of getting mortgage money from insurance companies, savings banks and trust companies. The matter has come up for public discussion at New York in connection with an inquiry on the raising of rents. The insurance companies recently made their defense. They admitted that their building loans had been heavily curtailed, but maintained that that had been done in order that they might invest in Liberty Bonds. The Government's necessity, they contended, took precedence over the housing demand. The unfortunate part of the situation, however, is that with the signing of the armistice large funds did not become available immediately for building loans because the companies had subscribed on their credit and even now have large payments to make. Probably the investment situation of the savings banks and trust companies is similar. In that case the building field cannot expect a heavy supply of mortgage money until the fall. That funds will be made available as quickly as the institutions can divert them to mortgages seems probable, for the return is lower on Government securities. Of course, one may expect on long-term mortgages a demand for a higher security margin than in the past, due to the present high construction costs. In any event, judicious pressure should help hasten progress in the matter of building loans, for at New York the companies concluded, as a result of the discussions, that they could find some $30,000,000 of mortgage money. The thought is worth passing on to the many other communities faced with housing shortage. The situation is one "affected with a public interest," an angle that the controllers of the public's funds as accumulated in the insurance and savings companies are not slow to grasp.

Partial Government Ownership of Railroads in Canada

GOVERNMENT ownership and operation of a large portion of Canada's transportation system are to be carried out under the terms of the bill providing for the incorporation of the Canadian National Railway Co. to take over and operate the properties of the Canadian Northern System, passed by the Canadian Senate May 27, as noted in the news section of this journal June 5. The fact that the passage of the bill has caused little comment may be ascribed to its being a natural outcome, although but a partial solution, of Canada's railroad problem, which has been brought about by the previous riot of ill-advised construction and by extravagant public gifts and guarantees, supported on an unsound financial structure.

Briefly, it is provided that the Canadian National Railway Co. shall be incorporated, with a board of directors nominated by the Governor General in Council, to take over and operate the properties of the bankrupt Canadian National System. Any deficits or surplus earnings from the operation of the lines will be paid out of or accredited to the national treasury. The capital stock of the company is to be vested with the Minister of Finance. Opportunity is provided for the indefinite extension of Government ownership and operation of public utilities through the insertion of a clause providing for the transfer to the control of the Canadian National Railway Co. of "any railway company, or of any other company having corporate powers or properties which may be conveniently exercised or operated by the company," in which the Canadian Government may have acquired the controlling interest. It may reasonably be assumed that the clause is destined to be applied to the Government-financed National Transcontinental and the Intercolonial Lines.

A little over two years ago the Royal Commission, composed of Sir Henry L. Drayton, W. M. Acworth and A. H. Smith, appointed to investigate Canada's desperate railroad situation, rendered its report. The Drayton-Acworth report, which recommended the virtual taking over into Government ownership of the Grand Trunk, the Grand Trunk Pacific, the Canadian Northern, the National Transcontinental, and the Intercolonial Lines, is partly carried out under the terms of the present bill. The minority report of A. H. Smith—to retain private operation and ownership of the lines, dividing the business into definite geographical sections and distributing the physical properties among the companies accordingly—has evidently been flatly rejected. The alternate plan of W. F. Tye, previously chief engineer of the Canadian Pacific, recommended that all of the railroad lines in Canada, with the exception of the Canadian Pacific, be unified, so that there would be created a transcontinental system which would be a worthy competitor of the strong Canadian Pacific. As

expressed by this journal editorially (May 7, 1917, p. 370), the Tye plan seemed more commendable than either of the others. It now appears that it is likely to be carried out, although under Government ownership, through the provision of the bill which permits indefinite extension of the control of the new company.

We can find no parallel between the railroad situation in Canada and that in the United States. Canada's railroad troubles were at first brought about by ill advised expenditures for new construction and the founding of companies on shadowy financial bases, backed by Government guarantees. The result was inevitable. In this country, the vast majority of railroad properties are in sound financial condition, granting that many, previous to rental by the Government, were living from hand to mouth, due to the persistent refusal of the Interstate Commerce Commission to grant increases in rates sufficient to meet increasing operating expenses and give an adequate return on the investment. While Canada has been oversupplied with transportation and her railroad troubles started with unwise expenditures for capital account, the United States has been under-supplied, and its chief difficulties lie in ever-increasing operating expenses, with gross revenues insufficient to operate the lines and pay rental to the owners.

The United States should be keenly interested in the railroad situation in Canada, not only for the reason that its railroads connect with Canada's, are physically like them and are in competition with them, but also because Canada's participation in railroad ventures has not proved fortunate, and holds lessons for us in the railroad settlement we must soon undertake.

The American Water Works Association

WITH 7500 water-works to draw upon, besides engineers, chemists and bacteriologists in private practice and a thousand or more water-works manufacturers and contractors, the American Water Works Association attained some 1400 members at high-water mark. Its membership should be at least 5000. The recent slight decline in membership may be attributed to war conditions; otherwise it would be discouraging, as perhaps it is, anyway. The falling off in technical-committee work during the past few years may also be laid to war conditions in large part, but this does not seem to be the sole cause.

Whatever may have retarded growth in membership and committee work in the past, and kept the association from entering that larger field of usefulness to be expected from a national organization of water-works men, should not hold in the future. That members having the advancement of the association at heart feel this was evident at the Buffalo convention of the association last week. Official measures proposed for meeting the situation, or at least for increasing and holding the membership, were: (1) Publishing the *Journal* six instead of four times a year and continuing the recent practice of including a considerable number of original contributions; (2) organizing sections in each state where the membership is 20 or more. Budget provision was made for greater frequency of publication, and approval was also given to the use of original contributions. It would be hard indeed to argue successfully against either of the branches of the first proposal. The second proposition is also good so far as it goes, but a hard drive for additional members, and doing more than is now being done for the membership, for the water-works fraternity in general and for the country at large, are two great needs and duties of the association.

More members and more service should be the slogan. Service alone would do almost as well, for nothing would bring new members so fast and hold them so long as increased service to them, the interests they represent and the general public.

Additional members would bring increased income, but how provide funds for the added service which is essential to gaining and holding members? One means is directly at hand. In recent years the association has not only made good a deficit but it has also created an "investment fund." This fund totals $13,000. It is proposed either to draw somewhat upon this fund, or lessen additions to it, for useful current work of immediate benefit to the members. This appears to be so wise a policy that it seems strange that it was not adopted earlier. If the *Journal* be made a more frequent and helpful visitor, the association would get and keep a stronger hold on its members. Then, if in addition to this a material increase could be made in the small sum appropriated for committee work, the association might expect to make rapid progress.

The need for more money for committee work seems to be forcibly illustrated by the position of the association in relation to the American Electrolysis Committee. The association's members of this committee seem to be handicapped for funds, as compared with the representatives of the other utilities on the committee. The peculiar and almost isolated position of the American Water Works Association in this electrolysis matter—most of the other utilities being in more or less close affiliation with the utility creating the electrolysis problem—makes it particularly desirable that the association be able to take a strong stand. To do this funds for its members on the joint committee are needed.

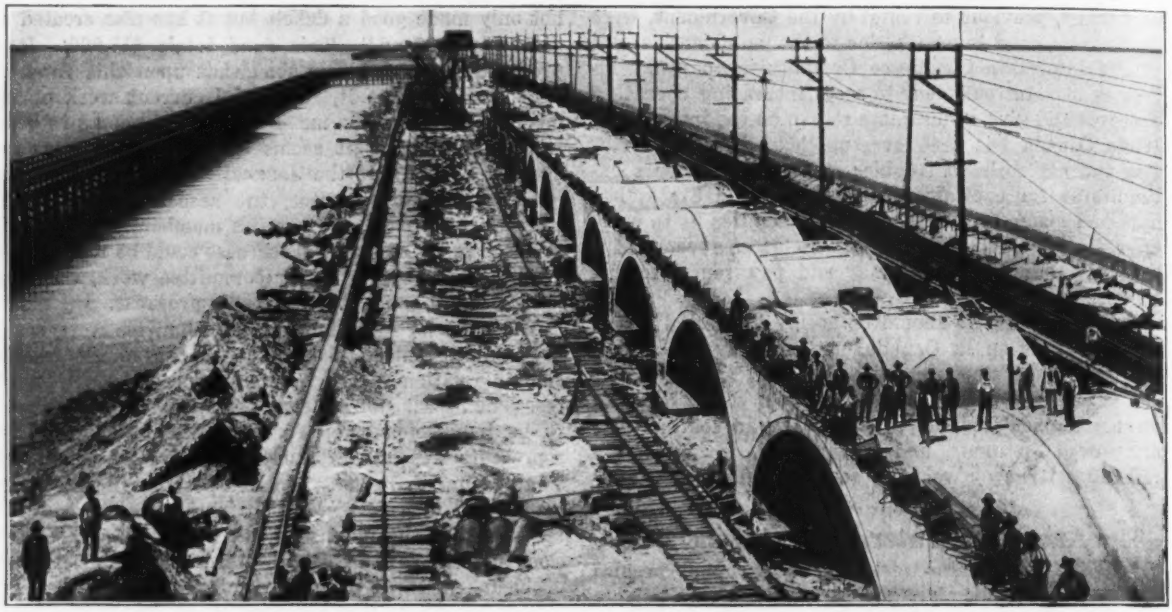
An unofficial proposal for promoting the association discussed at Buffalo was an increase in membership dues. This might strengthen the association in some respects, but it would tend to decrease the membership, or retard its rate of growth, and thus might pull down income. The members who dropped out and the prospective members kept out by higher dues need what the association has to give. Conceivably, they might be served by relatively low-priced membership in state sections, which would cover subscription to the *Journal*. Probably a rather high membership fee in the parent association would be necessary under a plan for local-section membership carrying with it receipt of the *Journal*. An extension of corporate membership, under which a city or water company joins the association, might help solve the problem of increased dues.

Finally, as has long been evident, what the association must come to, if it is to do its full duty, is to have one or more full-time officials. At the start a secretary-editor would do very well. Such an official, with a moderate amount of clerical help, could be an ex officio member of all committees that need to carry on correspondence. He could also do a certain amount of research work for some of the committees. Until some such plan is put into effect the American Water Works Association is not likely to grow as rapidly as it should and, failing to adopt it, actual decline may come.

Construction of New Arch Section of Galveston Causeway

Centrifugal and Jet Pumps Mounted on Derrick Platforms—Permanently Lagged Steel Arch Centers—Old Causeway Walls Used for Cofferdam

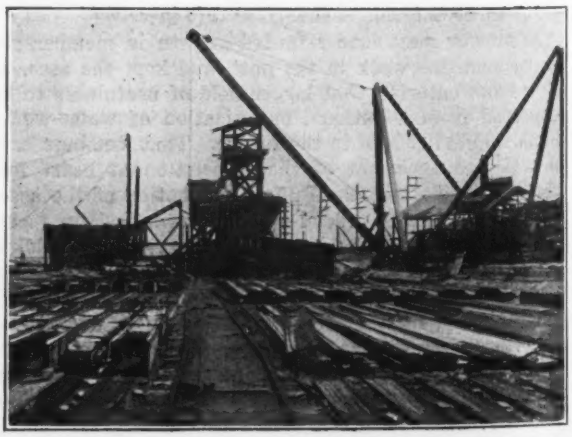
OF MORE than a mile of earth fill which formed about two-thirds of the Galveston causeway prior to the storm of August, 1915, only the low concrete walls and the concrete sheet piling below them remained after that catastrophe. As communication with the mainland was then possible only by altogether inadequate ferries, two temporary trestles of wooden piles were built immediately—a highway structure several hundred feet distant to avoid interference in rebuilding the causeway, and a railway trestle along the old line of track which is still in use for the main portion of Galveston's railway traffic and by the Houston interurban electric line. Location of the highway trestle too far away to be of use for construction purposes, and constant service required of the railway trestle, combined with the fact that the bay was too shallow for water craft along the causeway, made necessary the use of the bottom of the bay along the structure for location of equipment and for transportation of material.



REBUILDING CONCRETE ARCH SECTION OF CAUSEWAY, USING OLD SHEET PILING TO FORM COFFERDAM

The old sheet piles and walls were well situated for forming a wide cofferdam to make this possible and allow the use of wide-gage derricks to handle the work on the new arches. Concrete plants at either end receive material either by railway or by barges passing through the deeper water at the southern end and a channel dredged from deep water to the northern end. Centrifugal pumps on the ground and on the platforms of the movable derricks, which also contained jet pumps, and two reciprocating pumps drawing water from several pumps, emptied the cofferdam. The portable steel arch centers were permanently lagged and moved ahead in halves by a derrick and a wide-gage car inside the cofferdam.

All the sand for the 80,000 cu.yd. of concrete and the 10,500 concrete piles came to the job in barges, while the stone came by rail, as did the 6,000,000 lb. of reinforcing steel. The 40,000 cu.yd. of excavation and the 53,000 cu.yd. of fill were handled by the derricks directly to and from the bottom of the bay. At the north end of the work, where the railway track facilities are better, a sand-unloading plant and a pile-concreting plant consisting of a mixer outfit and a form yard 300 ft. long, with storage for curing the piles, have been constructed in addition to the regular mixing plant. Three main construction tracks lead along the viaduct from this end. A narrow-gage track is used for moving the concrete piles and for general utility work. A 30-ft.-gage track is laid for the stiff-leg derricks. Outside of this is a narrow-gage track with switches, which is used for transportation of the concrete in four 1-cu.yd. bucket trains. For a part of the work a track on brackets along the railroad trestle carried the concrete for the foundations. At other places



REINFORCED CONCRETE PILE CASTING YARD AND PLANT FOR CONSTRUCTING GALVESTON CAUSEWAY

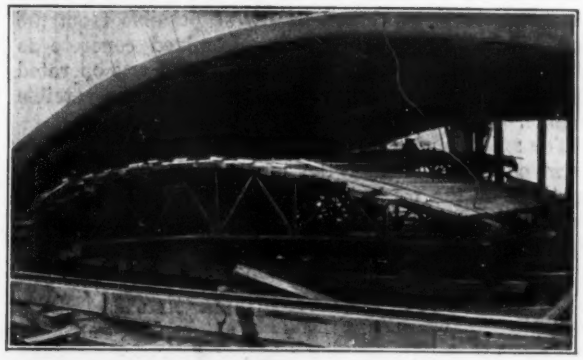
a narrow-gage track was placed on the near side of the derrick track, for convenience in moving material ahead.

The concrete sheetpiles and the walls surmounting them which retained the earth fill of the old causeway are far enough apart to allow working space between them and the new arches. In the construction of the new work these old walls are used as cofferdams and are found very tight. They are about 4 ft. above mean low tide, high enough to keep the water out except under strong winds. A 30-in. splash wall of boards has been built on the east wall to catch the ordinary spray of the waves. This is not water-tight, but throws the spray back and saves a great deal of pumping.

Most of the pumping is done by pumps mounted on the derricks. An 8- and a 10-in. centrifugal pump are used ahead of pier construction. A "line pump" system, composed of a locomotive-type boiler and two reciprocating pumps hitched in parallel, pumps from a pipe line with branches into the several sumps for 400 ft. each way from the power plant. By care in making the joints of this section line, it has been made to produce good results, and it is valuable in keeping the water down in holes behind pier construction and where other pumps are not available. Most of the derricks are equipped with 5- or 8-in. centrifugal pumps and with 3-in. duplex pumps for jetting. By moving several derricks into a desired section after a storm, it is possible to unwater it without much loss of time.

Both excavation and piledriving are done by the stiff-leg derricks—the former chiefly by clamshell. The piles are of concrete, varying from 19 to 35 ft. in length, according to the penetration which the soil will allow. They are driven with swinging leads hung from the ends of the derrick boom. A four-ton steam hammer of a medium quick-hitting type, with a special follower and double live-oak striking cushion, drives the piles with very little shattering of the concrete. When shattering occurs it is found always to be most severe at the top, and disappears completely in a foot or two.

Movable Steel Centers—Steel trusses with wooden lagging are used for the arch centers. The lagging is fastened to the trusses and moved with them. The trusses are of the three-hinged type, with a pin at the crown and jacks at either end. A tie-rod is provided about one-third of the way up to hold the trusses during erection. This is loosened before the concrete is poured. These trusses are removed after the concrete has set



STEEL ARCH FORM WITH LAGGING ATTACHED

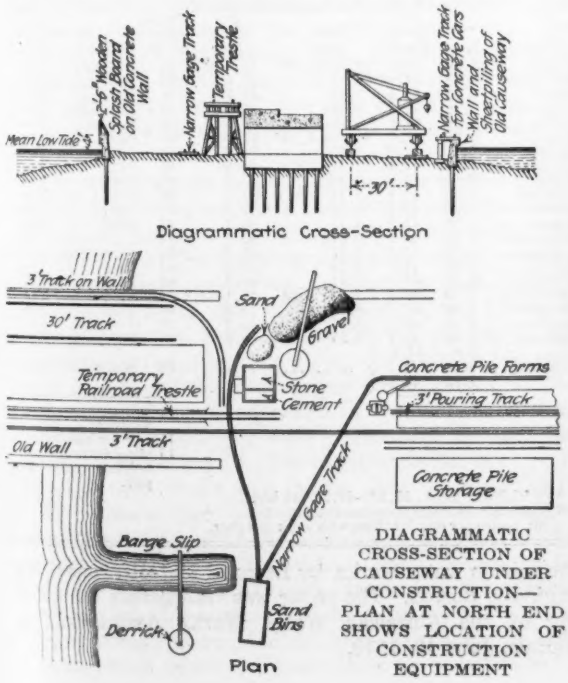
for 30 days. To strike them, the jacks are removed and the whole form is rolled part way out on rollers which replace the vertical jacks. Where the pins at the crown are within reach of the derrick they are removed, and the forms are lifted in halves and placed on a 30-ft.-gage truck for the removal to the next set-up.

During the latter part of the work narrow sections have been used, the railroad portion being poured first and then the highway, the lateral movement of the forms being accomplished without taking the trusses down. In setting up the forms the horizontal jacks are not placed until a day or two after the umbrella section over the pier has been poured.

The concrete plant at the north end of the work consists of a 1-yd. mixer with stationary measuring bins fed from wooden hoppers. These in turn are filled by a clamshell from car or storage piles of gravel and from piles of sand. This sand comes to the job in barges, and is unloaded by a derrick several hundred feet from the concrete plant into hoppers from which it is taken as required into side-dump cars. An endless cable operated by a reversible engine pulls the cars of sand up an incline, where they are dumped beside the mixer derrick. The mixer is arranged to dump into concrete buckets on flat-cars. One train is filled while the dinkey hauls one out and takes back the empties.

JACKING DETAILS AT ENDS

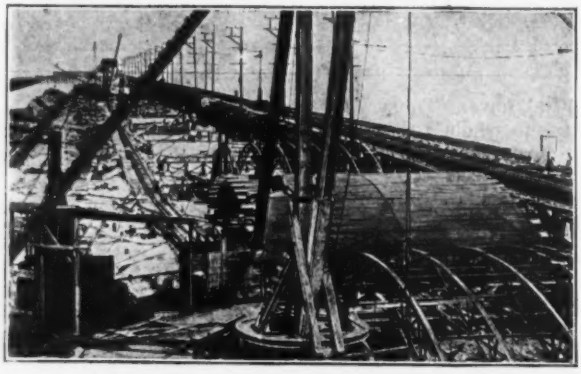
The reinforced-concrete piles used in the foundation work were made near the job in a special yard at the Virginia Point end. This concrete-pile plant had a mixer of its own and three tracks. The center one of these tracks was 3-ft.-gage and was used by the concrete car carrying the concrete to the forms. On either side of this, and between it and the standard-gage



DIAGRAMMATIC CROSS-SECTION OF CAUSEWAY UNDER CONSTRUCTION—PLAN AT NORTH END SHOWS LOCATION OF CONSTRUCTION EQUIPMENT

tracks, were the forms for the piles. The standard-gage tracks were for the locomotive crane which handled the piles. The mixer plant consisted of an ordinary bin plant with a ¾-yd. mixer. It had a small tower high enough to dump into the concrete car. This concrete car was of peculiar construction, being nearly 20 ft. high and having a concrete hopper at the very top. The reason for locating the hopper so high was to allow the concrete to be chuted as far as possible from the car. From the concrete car the mixed concrete is chuted some 25 ft. to either side. This car was operated by an endless cable which was attached to a reversible engine.

The space for the concrete forms was a wooden platform on either side of the inner track. The bottom portions of the pile form were nailed permanently to this platform. The sides were of 2-in. material, as were the bottoms. They were movable. One day was required before the side forms were removed. Four



PROGRESS IN ERECTION OF STEEL ARCH FORMS

days were required before the piles themselves were removed, and the total curing required 45 days.

As the length of the piles depended upon the depth of the sand stratum encountered at the site, an estimate was made from the borings at the foundation sites as to how many of each length would be required. About 75% of the piles were made from this estimate, with a few changes from time to time as foundations were put down.

As the second half of the railroad portion of the viaduct is yet to be built, any extra piles can be used there. After four days, the piles were picked up by a locomotive crane which handled them by means of two steel loops from the piles which were made a part of the reinforcing. After four to five days the piles were ready for driving.

With the exception of the handling of concrete materials, most of the crane work of the job was done by the wide-gage traveling derricks. Fourteen of these were single derricks with a platform 32 ft. square running on a track of 30-ft. gage. The boom was 65 ft. long.

A fifteenth derrick was double, being a little longer and having two booms, on opposite corners. Each derrick was equipped with one three-drum engine. Each platform or derrick outfit had a swinging engine, a 5- to 8-in. centrifugal pump, and a 3-in. duplex pump. Forge and work bench were also provided. These derricks were not equipped for rapid moving. They were moved by a line from the engine to a point at which it could be hitched ahead. This was entirely satisfactory, as

WIDE-GAGE TRAVELING STIFF-LEG DERRICKS WERE MOVED BY LINE FROM ENGINE

they were often left in one place for a considerable time and very seldom required quick movement. For doing particularly heavy work, or when left a long time in one place, the frames for the derricks were blocked up to save the tracks and wheels.

H. F. Jonas is supervising engineer on the present construction work, which is being done on a cost-plus-fixed-sum basis by Larkin & Sangster, Inc., contractors of Buffalo, N. Y. A. A. Sangster is in active charge of the work for the contractors, with R. B. Norris as his general superintendent. Thomas A. Lowe was general superintendent at the beginning of the present work.

Water-Works Labor Prices in Boston District

Prices paid for labor in April, 1919, by 17 water-works in and near Boston, Mass., with information as to holiday and vacation allowances, are shown in the accompanying table, taken from a paper on the effect of

LABOR PRICES PAID BY WATER-WORKS IN THE VICINITY OF BOSTON, APRIL, 1919

Place	Common Labor Per Day	Common Labor Per Hour Cents	Pipe Layers and Calkers Per Day	Pipe Layers and Calkers Per Hour, Cents	Hours per Week	Holidays	Vacation Two Weeks Paid
Boston	$3.00	41.0	$3.25–$3.50	44.4–47.8	44	Not paid	Yes
Somerville	3.25	44.3	3.35	45.6	44	Not paid	Yes
Newton	3.25	44.3	3.50	47.7	44	Not paid	No
Lexington	3.25	40.6	3.50	43.7	48	Not paid	No
Waltham	3.25	44.3	3.50– 4.50	47.7–61.3	44	Not paid	Yes
Everett*	3.75	51.1	4.25– 4.50	57.9–61.3	44	Paid	Yes
Malden	3.50	47.7	4.00	54.3	44	½ time	Yes
Chelsea	3.25	40.6	3.75	46.8	48	Paid	Yes
Quincy†	4.00	54.3	4.50	61.3	44	Paid	Yes
Medford	3.50	47.7	3.75	51.1	44	Paid	Yes
Melrose	3.50	47.7	4.00	54.3	44	Paid	Yes
Revere	3.50	47.7	3.75	51.1	44	Paid	Yes
Watertown‡	3.50	47.7	3.75	51.1	44	.....	.....
Arlington	3.75	51.1	4.25	57.9	44	6 out of 10	Yes
Milton	3.50	47.7	3.93	53.5	44	Paid	Yes
Winthrop	3.50	43.7	3.75	46.8	48	Paid	Yes
Cambridge	3.50	47.7	3.75– 4.00	51.1–54.3	44	Paid	Yes
Brookline	3.50	47.7	4.17	56.8	44	Paid	Yes
Marlboro	3.50	43.7	3.75	46.8	48	Not paid	No
Hudson	3.50	43.7	3.75	46.8	48	Not paid	No
Fitchburg	3.36 3.60 3.92	42.0 45.0 49.0	.....	.....	48	Not paid	Yes
Average		46.1					

16 allow two weeks vacation;
11 pay for holidays;
15 allow Saturday half-holiday under full pay.

* In Highway Dept., $3.50—47.7c. per hour.
† High on account of Government activities
‡ 50c. bonus per day for those who work one year.

the war on water-works, by Leonard Metcalf, consulting engineer, Boston. The paper was read before the meeting of the American Water Works Association in Buffalo, June 10, 1919.

Progress and Problems in the Field of City Water-Supply

Abstracts of papers before the American Water Works Association at Buffalo—New reciprocating pumping engine, chlorination and typhoid reduction, effect of war on water-works finances, pitometer survey and house-to-house inspection at Buffalo, need for standardization of flanges for light cast-iron pipe

The "Unaflow" Pumping Engine

By D. A. Decrow

Chief Engineer, Worthington Pump & Machinery Company, Harrison, N. J.

THE "Unaflow" steam engine derives its name from the fact that the steam travels into and through the steam cylinder in one direction; it does not counterflow or return over its own path. It is not particularly new in principle, but its development as a practical and economical commercial machine is quite recent, and its adaptation to reciprocating pumping engine practice is new. After much experimental work by various inventors Prof. J. Stumpf overcame previous difficulties, and to him undoubtedly falls the honor of making the first practical and commercially successful application of its principles to modern steam-engine practice.

The general principle of the "Unaflow" reciprocating steam engine is that of utilizing the heat energy of the steam in the cylinder during the period of its admission, expansion and flow in one direction, the expanded steam being released or exhausted through ports or openings uncovered by the travel of the cylinder piston at that period of its stroke most remote from the point of admission.

In the accompanying sketch of a typical "Unaflow" engine the piston is at one end of the stroke with the exhaust ports uncovered. The arrow indicates the path of the steam through the cylinder. The indicator diagram shows that steam is admitted into the cylinder for only a very minor portion of the stroke and is then cut off, the work performed during the remainder of the stroke being due to the expansion of the steam after the inlet valve closes. The exhaust opens when the piston, which is much longer than the ordinary steam-engine piston, travels past and uncovers the exhaust ports midway between the two ends of the cylinder.

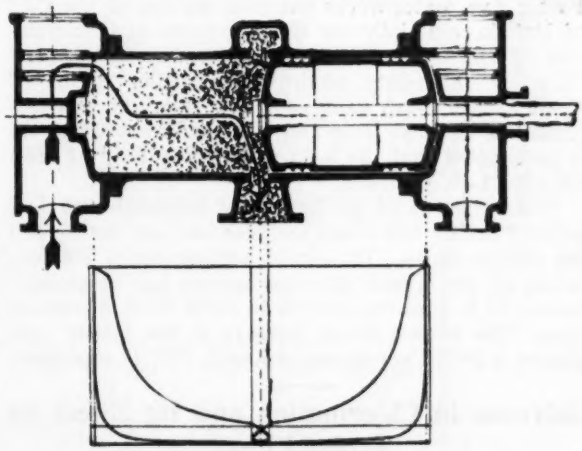
Beginning with the steam in the cylinder, there is practically no change of temperature until the point of cut-off. After cut-off, expansion takes place with a consequent drop in temperature and at this time condensation begins, due to the changing of heat into work. As the cylinder head is jacketed with high steam, no condensation takes place on the walls of the head, but the condensation is on the wall of the piston, which is comparatively cool and adjacent thereto, so that at the end of the stroke, when the piston uncovers the exhaust ports, the moisture of condensation is mostly at the exhaust end of the cylinder, and as the steam expanding away from the cylinder head rushes out through the exhaust port, it carries the moisture with it.

At this time there is a sudden drop of temperature in the cylinder due to the sudden drop of pressure, but as the inlet end of the cylinder is dry it does not lose its temperature. The exhaust port is covered by the piston on the return stroke, trapping in the cylinder comparatively dry steam partially superheated. As the walls of the cylinders have retained their heat, the heat of compression is not absorbed either by moisture or by cold walls, as in the case of a counterflow engine, and the steam remaining in the clearance is heated by compression to a temperature above the temperature of the initial steam. When the valve is opened to start the next stroke, the live steam rushing in goes into a clearance space in which the steam entrapped is hotter than the entering steam, hence there is no initial condensation. Owing to the complete removal of all the mixture of each stroke, the well known heat losses that are caused by the presence of water in the counterflow engines are avoided.

Eliminating initial condensation permits an economically high ratio of expansion in one cylinder. For normal working conditions about 16 expansions have been found to give best results.

It is also evident that, with the use of exhaust ports in the cylinder instead of the usual exhaust valves, leakage losses at the exhaust valves and of all of the added clearance space and surfaces, which losses necessarily follow from the use of a special exhaust valve, are eliminated. It has been found practical to reduce the clearance space in condensing engines to 3% of the swept volume of the piston.

Some of our manufacturers of "Unaflow" steam power engines have guaranteed as low as 10 lb. of steam per



TYPICAL "UNAFLOW" STEAM CYLINDER AND INDICATOR CARD

indicated horsepower per hour, and some of the tests of European built engines have shown well under nine pounds.

Taking into consideration its simplicity—for with a single cylinder substantially the same economy is obtained as with the best types of compound- or triple-expansion steam engines—the "Unaflow" engine marks a distinct step in advance of the other types of reciprocating engines. These advantageous features have attracted attention to its desirability as a motive power for reciprocating pumping engines.

To develop a pump that could be combined with and utilize the advantageous features of the "Unaflow" engine requires that due consideration be given to proper

"UNAFLOW" TEST PUMPING ENGINE AT BUFFALO

channels for passing the desired amount of water to and through the pump with the least practicable amount of deflection and disturbance of the flow. This can best be attained by incorporating the "Unaflow" principle in so far as it will apply to a pump. The pump should be provided with passages ample and direct, so there will be no reversal of flow, with plungers properly proportioned and formed to cause a minimum disturbance, with suitable suction and discharge air chambers properly located with pump valves that will deflect the direction of flow as little as possible, that will operate quickly and quietly at all pressures and economic speeds of the engine, and, furthermore, that will be durable and lasting in operation.

One of our pumping engine manufacturers has designed, constructed, erected and will operate in the Porter Ave. water-works pumping station of the City of Buffalo, especially for the inspection and information of the members of this convention, a complete "Unaflow" high-duty condensing pumping engine of about 3,000,000-gal. daily capacity. Tests of this machine will be made later and the results published. It is anticipated that the tests will show a duty of 180,000,000 ft.-lb. of steam.

This engine is of the horizontal extended type (so-called), having one steam cylinder and one double-acting plunger pump. Its normal working water pressure is 100 lb. per square inch; the suction left is approximately 15 lb. plus the friction in about 60 ft. of suction pipe. The normal steam pressure at the Porter Ave. station is 235 lb. per square inch with 100° F. superheat.

Advance in Chlorination and Its Effect on Typhoid Fever

By John Kienle
Sanitary Engineer, Electro-Bleaching Gas Company, New York City

CHLORINATION of public water-supplies has been the most noteworthy single contribution to the art of water purification in recent years. The effect of this method of water treatment in reducing the typhoid mortality of the country at large is attested not only by the statistics but by the increasing demand of public health authorities for this method of protection.

Chlorination of water by the hypochlorite of lime method was first carried out successfully in the United States by George Johnson at the Union Stock Yards at Chicago in 1907, and almost immediately followed by the treatment of the Jersey City supply at Boonton. By the end of 1911 approximately 500 water plants had been equipped with hypochlorite installation. In 1912 the use of liquid chlorine was announced at the Minneapolis convention of this association. Although the increase in the use of hypochlorite was quite rapid following its appearance at Boonton, the rate of growth of the liquid-chlorine process was even more remarkable. From only one water plant (Niagara Falls), equipped at the end of 1912, the number at the end of 1918 had jumped to approximately 2500.

In 1907, the United States Census Bureau tells us, the typhoid-fever death rate in the registration area, with a population of 41,758,000, was 30.3 per 100,000, and the estimated number of deaths within the year for the entire country was approximately 30,000. There were then no chlorinated water-supplies. In 1917, according to the United States Public Health Service, the rate had dropped to 12.3 per 100,000, with the estimated number of deaths stated at 13,000, and in this year there were at least 2000 public water-supplies that were chlorinated. Thus 17,000 lives were saved from death by typhoid in one year. This is a saving of over $125,000,000 annually.

It has been aptly stated that the chlorination of public water-supplies is the cheapest municipal insurance that can be obtained, the average annual premium amounting to not more than 40c. per 1,000,000 gal. of water treated, or, for a municipality of 5000 or less, an annual expense of $150 per annum ($36.50 operating, and $120,000 depreciation at the rate of 20%) or a cost of 3c. per capita, based on the same figure of 5000 population.

Effect of the War Upon Water-Works Revenues and Expenses

By Leonard Metcalf
Consulting Engineer, Boston, Mass.

THE situation with regard to the water-works of the United States is probably fairly shown by the accompanying comparative records of about 50 plants with aggregate annual revenue of about $35,000,000 and supplying a total population of upwards of 9,000,000 persons, or nearly 9% of the entire population of the United States. The data for 1914-17 were presented to the association a year ago by its committee on war burdens of water-works. The 1918 figures have been collected and added by the writer. These records indicate that:

1. The annual revenues with such increase in rate schedules as were granted by the regulatory authorities

TABLE I. COMPARATIVE WATER-WORKS REVENUE AND EXPENSE, 1914-1918, IN PERCENTAGES OF 1915

Group	1914	1915	1916	1917	1918
Percentage Gross Annual Revenue					
Eastern	95.7	100	110.1	112.8	120.6
Central	98.3	100	109.1	111.4	126.4
Southern	97.7	100	107.5	120.3	126.3
Western	101.7	100	107.3	109.5	117.5
Average	98.3	100	108.5	113.5	122.7
Percentage Operating Expenses, Including Taxes					
Eastern	99.7	100	121.9	141.1	149.7
Central	100.9	100	109.3	137.3	162.3
Southern	97.0	100	109.7	134.6	165.9
Western	98.6	100	109.9	117.4	128.0
Average	99.0	100	112.7	132.6	151.5
Net Revenue Applicable to Depreciation, Interest, Dividends and Surplus					
Eastern	90.9	100	103.0	90.4	105.8
Central	97.3	100	110.0	98.5	106.5
Southern	97.9	100	96.3	104.0	89.1
Western	103.6	100	104.3	105.3	114.4
Average	97.4	100	103.4	99.6	104.0

and put into effect by the plants, have increased at an average rate of approximately 7% per annum, slightly less than a normal amount.

2. The operating expenses, including taxes where taxes are paid, and excluding them where none is paid, have increased over the year 1915 abnormally, by 13% in the year 1916, 33% in the year 1917 and 52% in the year 1918.

3. The net (operating) revenues applicable to depreciation, interest, dividends and surplus, have substantially stood still since the year 1915.

The average increase in population in this country has been at the rate of approximately 1.9%, compounded annually, and of the cities supplied by these 50 typical water-works, about 3.1 per cent.

The net revenue of water-works usually increases at the rate of from 4% to 5%, compounded annually. Yet the total increase in the three-year period from 1915 to 1918 is but 4%, against a normal amount of from 12% to 15%, in spite of increases granted by the commissions.

The records gathered indicate further that the increases in rates granted to water-works by the commissions seem to have amounted on the average to about 10%, serving thus to decrease the loss in net revenue in the year 1918, from 20%, more or less, to 10% or thereabouts. If this inference is sound, the loss in operation was divided equally between the works and their consumers.

It is clear, however, that the burden of increased operating expenses, plus the interest upon the new investment put into these properties during the war period, has been *borne by their owners*, in larger measure than by the public, except in the case of publicly owned works.

Unskilled Labor Costs, in cents per hour (see Table II) did not generally feel the influence of the war until the middle of the year 1916. As compared with pre-war conditions, reflected by the prices prevailing in 1915, they increased one-eighth in 1916, one-fourth in 1917, and nearly three-fourths in 1918. The increase was felt most markedly in the South and upon the Eastern seaboard, being nearly doubled in the first, and increased by three-fourths in the latter district. The wages paid upon the Pacific coast before the war, which were much higher, have advanced relatively less than elsewhere, so that at the present time the Eastern and Western unskilled labor prices are about the same. Thus the average rate in the Western group increased from 27c. per hour in 1915 to 42c. in 1918; while the Southern rate increased from 18c. to 34c.; the Central group from 22c. to 37c.; and the Eastern group from 23c. to 40 cents.

In spite of the general business uncertainty and resulting depression, wages paid to unskilled labor, by water-works in the vicinity of Boston, have advanced from approximately 41c. per hour, under date of Sept. 14, 1918, to approximately 46c. per hour in April, 1919, without allowance for the effect of vacations and holidays under pay, granted by some works. Present (June, 1919) conditions give little if any indication of reduction in prices this year, or hope for any marked reduction in the future.

Cast-Iron Pipe Prices (Table II) which had about trebled at their maximum point, have now receded to about twice pre-war figures. *Valves, Hydrants and Pumps*, which had more than doubled in price, are now to be had at an advance of something over seven-eighths of pre-war prices. *Coal and Fuel Oil Prices*, which more than doubled, have receded somewhat. *Chemicals* used in the purification of water, which, by reason of outstanding contracts showed an average advance of but one-third, though the market price had increased approximately three-fourths, have decreased so that the present excess cost is about one-half over pre-war prices.

Future Prices—Engineers prefer the rôle of interpreter of facts to that of prophet. It is desirable, however, to note here probable future price tendencies. First, with respect to unskilled labor, no marked change is to be looked for; and with respect to the rates paid to water-works employees, it is believed that the prices now paid are likely to continue in most cases, and to increase rather than to decrease in the remaining cases.

TABLE II. INCREASE IN COST OF LABOR AND MATERIALS TO WATER-WORKS IN THE UNITED STATES, AS REPORTED TO THE EXECUTIVE COMMITTEE OF THE AMERICAN WATER WORKS ASSOCIATION, MAY, 1918, AND REVISED, APRIL, 1919, BY LEONARD METCALF

Item	Number of Records	Prices per Unit				Per Cent. Increase Over 1915			Year 1918		
		1915	1916	1917	3 Mos. 1918	1916	1917	3 Mos. 1918	No. of Records	Unit Price	Per Cent Increase Over 1915
Unskilled labor* in cents per hour:											
(a) Western Group	7	27.0c.	28.5c.	31.4c.	Still	5.0	16.0	Still	8	41.8c.	54.7
(b) Central Group	12	21.7	25.3	26.9	increasing	17.0	24.0	increasing	10	37.2	71.3
(c) Eastern Group	15	23.0	26.7	30.4	in 40.6%	16.0	32.0	in	18	40.2	74.7
(d) Southern Group	10	17.9	20.6	24.5	of all	15.0	37.0	all	12	34.3	91.6
(e) Average of Groups (4)	..	22.4	25.3	28.3	groups	13.0	27.0	groups	4	38.4	71.2
(f) Average of all	44	22.1	25.2	28.3	.....	14.0	28.0	.....	48	38.4	73.2
Cast-iron pipe, per 2000 lb.	21	$24.23	$30.70	$51.60	.....	26.7	112.9	.....	..	$67.74	179.0
6-inch valves	11	11.18	12.64	19.13	$23.20	13.1	71.1	107.6	23	19.13	71.0
12-inch valves	3	34.78	41.53	65.22	69.00	19.4	87.6	98.7	10	65.02	87.0
Two-way hydrants	6	26.69	32.04	43.13	53.90	20.1	61.6	102.0	38	5.80	94.0
Coal, per 2000 lb.:											
(a) Eastern Group	13	$2.98	$3.80	$5.96	$7.04	27.5	100.0	136.3	16	6.00	101.0
(b) Central Group	11	2.41	2.77	3.75	6.38	14.9	56.4	164.7	10	4.53	88.0
(c) Southern Group	12	1.92	2.01	3.03	4.02	4.7	57.8	109.4	10	3.89	102.0
(d) Western Group	5	3.97	4.37	6.31	7.89	10.1	58.9	98.7	6	7.92	99.0
(e) Average of Groups (4)	..	2.82	3.24	4.77	6.33	14.9	69.2	124.4	4	5.57	97.0
(f) Average of all	41	$2.62	$3.04	$4.52	$5.69	15.3	73.7	117.1	42	$5.42	107.0
Fuel oil, cents per gallon—South	1	1.80c.	1.80c.	2.00c.	4.50c.	0.0	11.1	150.0	1	4.28	138.0
Fuel oil, cents per gallon—West	1	1.38	1.50	2.57	3.55	8.7	86.2	157.3	4	4.05	193.0
Alum, cents per pound											
(a) Western Group	2	1.14c.	1.21c.	1.51c.	.....	6.1	41.4	.....	3	1.53c.	34.0
(b) Central Group	5	0.91	0.91	1.25	.....	0.0	37.0	.....	6	1.50	65.0
(c) Eastern Group	9	1.12	1.72	1.48	.....	54.0	32.7	.....	8	1.45	29.0
(d) Southern Group	9	1.08	1.38	1.48	.....	28.0	37.0	.....	9	1.78	65.0
(e) Average of Groups (4)	..	1.06	1.30	1.43	.....	23.3	35.1	.....	4	1.56	47.0
(f) Average of all	25	1.07	1.40	1.44	.....	30.6	34.4	.....	27	1.59	49.0
(g) New York market price†	Average of Monthly Prices	2.08	4.63	3.57	5 Months 3.15	123.0	71.6	51.4	..	.....	.....

* Note. It was generally reported that there has been also a marked decrease in efficiency of labor since 1914, variously estimated at between 20% and 50%; and that the increase in wages paid to labor by water-works had not kept pace with contract prices, owing probably to the advantage of continuity of service.

† See *Journal of Industrial and Engineering Chemistry*. Note that 1915 price was an advance of 34% over the 1914 average price before the advances listed went into effect.

Unless Bolshevism runs its course in this country, or industrial depression should follow the war—neither of which seems likely—an active demand for labor is to be looked for in the near future. It is to be remembered that, despite the war, the population of this country has been increasing at a rapid rate. Immigration has been at a standstill, and in the light of home demand for labor abroad, does not seem likely to be active for some time to come. Many employers, contractors and labor leaders believe that in the not distant future this country is sure to feel the competition for available labor and that this will stimulate yet higher wage scales.

Necessary Improvements Should Go Forward

Second, with respect to materials of construction, there is greater hope for relief. Nevertheless, no substantial reduction in the price of cast-iron pipe, valves and hydrants seems likely for the present year, and but a gradual reduction is to be looked for in the future. In spite of the increased facilities for production, the labor, transportation and money conditions involved seem likely to make themselves adversely felt for some time, and the losses resulting from the war seem likely to be permanent.

Third, the materials of operation—coal, fuel oil, and chemicals—do not appear likely to decline markedly in cost, and such tendency toward decrease as there may be will probably cause the making of short-time, rather than long-time, contracts for such supplies.

The Future—The conclusion to be drawn from the present physical and financial condition of water-works in the United States seems clearly to be that *necessary improvements should go forward as rapidly as possible.* It is desirable to restore public confidence and further the Government's wise wish to give employment to idle labor. More important yet, *improvements are seriously needed to restore our normal high standard of water service, to safeguard adequately the public health.*

While city officials and water-works men are hesitating, the large manufacturing interests, dominated by shrewd, farsighted business men, are going ahead with their construction work, with their plant extensions and housing projects, confident that postponement will at best offset increased cost in small measure; will probably involve loss in service or profit far exceeding any saving in construction cost; and at worst will involve yet higher costs, coupled with increasing difficulties due to a vanishing labor surplus.

The public is far more vitally interested in thoroughly good and adequate present service than in any probable saving to be effected by delaying construction to a later date, in anticipation of further, more or less problematical, decline in costs.

Reduction of Water Consumption By Pitometer and Inspection

By George C. Andrews
Water Commissioner, Buffalo, N. Y.

In 1897 the Buffalo common council decided it would be more advantageous to its citizens to install additional pumps and give practically an unlimited supply of water than to control consumption by means of meters. It would be interesting to speculate on what that decision has cost the citizens of Buffalo in the past 22 years. Suffice it to say that in 1903 the Bureau of Water had a bonded debt of $3,699,382 while it was $12,141,524 in 1917. In 1903 there was one pumping station, with a daily capacity of 183,000,000 gal. In 1917 there were two pumping stations, with a combined daily capacity of 330,000,000 gal. Coincident with the increased pumping capacity large distributing mains were laid. During this period the per capita consumption ranged between 302 and 339 gal. per day. Of this practically 100 gal. was for industrial use.

In 1916 a commission of five men was selected to govern the city. One of its early efforts was an investigation of means to reduce the water consumption by the city.

As all water used must be pumped from Lake Erie against a head of 140 to 204 ft., a reduction in pumpage would make an immense saving in coal for fuel. In the spring of 1917 it was decided to start a pitometer survey. This was supplemented by house-to-house inspection. Metering was considered, but was rejected on various grounds, some of which were the following: Popular local predjudice against metering; length of time to meter the city completely, there being over 76,000 unmetered and active services, while the pitometer method promised early results; extensive changes in plumbing required should meters be installed in many of the poorer types of dwellings; heavy initial investment required for meters.

To make the survey, an engineer in charge and four assistants were employed. Three trucks with gangs of four were constantly engaged, and one clerk was assigned to this work to keep the records. Twelve of the regular city inspectors made the house-to-house inspections. Later, as more of the city was covered, 20 temporary inspectors were engaged. One of the assistant engineers made the district measurements, and two were constantly engaged on subdivision. An assistant engineer tested the meters and fire lines. During the winter months two men worked in the office.

Bureau Intends To Continue Pitometer Work

As work was completed in each division, a permanent map was filed in the office, showing gaging points for instrument and valves on boundary points. On this map are recorded the date of the first measurement, 24-hour consumption and minimum night rate, and same record of second measurement. It is the intent of the bureau of water to continue the pitometer work as a special department. Regular measurements will be taken at varied intervals, and these maps will facilitate the work greatly. All inspectors' reports are filed by streets and can be referred to instantly. As soon as a section was completed, a full report on it was submitted by the engineer-in-charge. This report gave a general summary of the work, with certain specific recommendations to meet the conditions for the sections. These reports are filed so as to be available for future reference.

Our first section was surveyed in 1917, and this year remeasurements have been taken. These show that there is a more or less gradual return of the waste first eliminated, depending wholly on the character of dwellings. In all sections the consumption was less than it was two years ago, at the time of the first measurement. I estimate that effects of the result of the survey will be from one to three years as far as house waste is concerned. All underground leaks stopped are a permanent saving.

Nine-tenths of the city has now been covered by the survey, with the following results:

House waste stopped, 18,000,000 gal. (estimated)
Underground waste stopped, 12,000,000 gal., actual measurement
33,278 leaky fixtures reported and repaired
1860 leaky services reported and repaired
52 unfinished supplies found wasting 3,587,000 gal. per day
Broken mains and leaky joints wasting 4,376,000 gal. per day found and repaired

The pumpage has been reduced, except in times of extremely hot or cold weather, to less than 125,000,000 gal. per day, as compared with over 160,000,000 gal. per day in 1917. Figuring the cost of pumping at $6.24 per 1,000,000 gal., the average cost for the past three years, the annual saving is $68,328. Against this is the estimated charge of $25,000 per year to maintain the pitometer division of the bureau. To date the survey has cost $96,931, much of which represents permanent investment in equipment and records, or for professional services. Including the pay of temporary inspectors, who will be employed each spring, it is estimated that the annual cost of continuing the work will be $25,000 per year.

From the survey made and the results obtained, it is evident that to a certain extent the house waste can be greatly reduced by house inspection controlled by pitometer measurements. When these measures are used in conjunction with selective metering, the most flagrant house waste can be eliminated and the consumption reduced nearly to that obtained by universal metering, and done at less expense. The pumpage can be reduced at least 20,000,000 gal. by the installation of 10,000 meters on house services where tremendous waste has been found by the survey. The installation of these meters is now proposed. A further reduction is not deemed advisable until a filtration plant is built.

A comparison between the cost of universal metering and the elimination and control of waste by the pitometer and selective metering is, briefly, as follows:

Control by pitometer and selective metering:	
Annual cost of inspection	$25,000
Installation of 10,000 meters, investment in meters, $100,000	
Annual charge on meters, interest at 4½%	4,500
Depreciation	4,000
Cost of reading and maintenance	6,000
Total annual cost	$39,500
Universal metering:	
Installation of 75,000 meters, investment in meters, $750,000	
Annual charges on meters, interest at 4½%	33,750
Depreciation, 4%	30,000
Cost of reading and maintenance	45,000
Total cost	$108,750
Annual saving in favor of pitometer control	$69,250

It is true that universal metering would reduce the consumption considerably more than the other method, but even if the reduction amounted to 20,000,000 gal. per day the saving in operation costs would not equal $69,250 per year.

Need for Standardization of Flanges for Light Cast-Iron Pipe

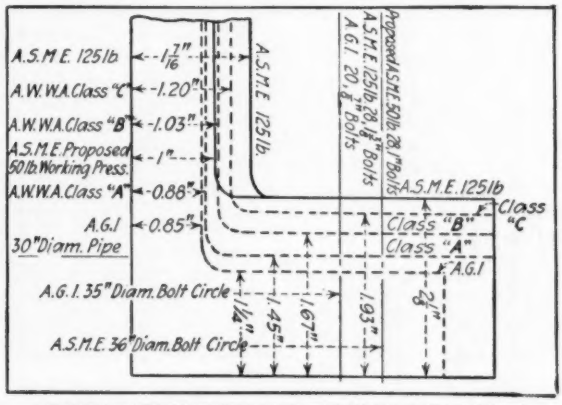
By John Knickerbocker
President of the Eddy Valve Company, Waterford, N. Y.

THE question of flanges for light cast-iron pipe has come up for discussion at various times, but up to now no final action has been taken. Early standardization is desirable.

To bring this subject to the attention of this association and all others interested, an illustration is presented showing the thicknesses of pipe, and thicknesses of flanges for American Water Works Association Class A, B and C pipe, the flanges for these pipes being calculated by the formula, thickness of flanges equals 1½ times the thickness of pipe, plus ⅛ in.; the thicknesses of pipe of the American Gas Institute, and the thicknesses of flanges and bolt circles adopted by them; the A. S. M. E. proposed standard for 50-lb. working pressure, and the American Standard [also A. S. M. E.] for 125-lb. steam working pressure.

It is a serious question whether the standard flange suggested by the American Society of Mechanical Engineers for pipe for 50-lb. working pressure is not too heavy and would cause casting strains and shrinkage where the flange meets the pipe. Or take the 30-in. pipe, Class A, American Water Works Association pipe, which is 0.88 in. thick. Would it be good foundry practice to cast a flange measuring 2⅛ in. thick to this thin pipe, and if the pipe were increased to 1 in. thick, the thickness proposed by the American Society of Mechanical Engineers for 50-lb. working pressure, would not the flanges 2⅛ in. thick be too heavy for the pipe?

The American Gas Institute pipe thickness for 30-in. pipe is 0.85 in. Taking the inside diameter of the



COMPARATIVE DATA OF FLANGES FOR LIGHT CAST-IRON PIPE

The proposed A. S. M. E. 50-pound working pressure and the American Standard have the same diameter bolt circle

flange at 31.7 in. (the outside diameter of the pipe), the weight of the American Gas Institute flange is 102.4 lb. and the flange proposed by the American Society of Mechanical Engineers for light pipe is 215.5 lb., which is over twice as much as the American Gas Institute 30-in. flange. If the American Gas Institute flange is heavy enough for Class A pipe, then for each flange 113.1 lb. would be wasted if the American Standard flange were used; besides the poor casting that might result from casting so heavy a flange on a light pipe.

If a flange 1.67 in. thick were used on a 30-in. Class B pipe, taking the outside diameter of the pipe as the inside diameter of the flange, it would weigh 169.38 lb. The American standard flange on this pipe would weigh 215.5 lb., showing a saving of 46.12 pounds per flange.

If it were possible to use the American Gas Institute flange for the Class A pipe, and a flange of the diameter of the American Standard, but between the thickness shown for the flanges for Class A and Class B pipe, as calculated by the formula already given, it might be a good solution of the question.

Would it not be well for the committee of this association which has this matter in charge to endeavor to take it up with like committees from the New England Water Works Association, the American Society

of Mechanical Engineers, the American Gas Institute, the Cast Iron Pipe Manufacturers, the Committee of Manufacturers on Standardization of Fittings and Valves, and such other organizations as might wish to be represented?

Progress by Engineering Council's Compensation Committee

Seriousness of Situation Considered and Principles for Classification and Salary Schedule Are Proposed

REPORTING at the recent regular meeting of Engineering Council, the committee on classification and compensation of engineers presented the following analysis of the situation and suggested the lines of its future action. Reports from separate sections of the committee are also briefly abstracted herewith:

In attempting to formulate standard rates of compensation for professional engineers, the first task is to find what rates are actually in force, especially in those fields where attempts at standardization have been made. The second task is to inquire what adjustment should be made to correspond to the great change which has taken place in the cost of living, or, in other words, in the value of the dollar. How great this change has been during the past 20 years is realized by few. Fortunately, an accurate determination is available in the statistical records of average prices which for many years have been gathered and published by leading commercial organizations.

A record of average prices of the necessaries of life kept by R. G. Dun & Co. shows that prices have increased continuously for 22 years. A certain quantity of staple necessaries could have been purchased July 1, 1897, for $72.45. By Jan. 1, 1905, the same quantity cost $100.32. On Jan. 1, 1914, before the outbreak of the war, the cost had risen to $124.53; May 1, 1917, to $208.43, and Oct. 1, 1918, to the maximum of $233.23.

Salaried Worker Has Had No Such Increase as Wage Worker

This enormous increase in prices of the necessaries of life has been accompanied by an increase in wages, especially among workers organized in unions which had the power to compel attention to their demands. In the unskilled labor market the relations of supply and demand raised wages during the war to points in some cases exceeding the increase in the cost of living. No such increase has taken place in the compensation of salaried workers in the professions. It has been assumed that these workers, living in a different social environment, had a margin of compensation sufficient to enable them to meet the increased cost of living. This assumption is not justified by the facts. Where salaries have been increased during the past three years, there are few cases in which the increase has been at all commensurate with the increase in prices of the necessaries of life, which the salaried worker, like the wage worker, has to purchase. That this is a correct statement is amply proved by many direct comparisons which have been made of the wages of the workers in various skilled trades and the salaries of the rank and file of technical and professional workers.

There is little doubt that an unprejudiced investigation would show that a large proportion of the salaried workers in professional occupations during the past three years have been unable to pay their living expenses from their earnings and have been obliged to rely on income from property owned or to use up savings of other years in order to maintain themselves.

A serious question is whether the present scale of prices is here to stay. There has been a general belief that with the coming of peace and the resumption of productive industries a heavy fall would occur. It has been assumed that the salaried worker would have to wait for this so that he could again live within his income. It now appears, however, to be the opinion of many financiers and economists that the present high prices of necessaries are likely to continue for a long time, probably for several years. The salary of $2000 a year which a man received from 1902 to 1905 will now buy less than $1000 worth of necessaries. This has been the case for two years. If this is to continue for two, three or four years to come, then surely the salaried worker, in a professional or any other occupation, has an equitable claim to have his compensation brought back in purchasing power to where it was fifteen years ago.

There is another aspect of the compensation of the professional worker which has been frequently misunderstood, but which, with present knowledge, ought no longer to deceive. The pay of professional engineers has for many years been influenced by the idea that a young man in the earlier years of his work should expect moderate compensation because of the future to which he might look forward. In Great Britain this idea found expression for many years in the custom of the young engineer paying a premium during a number of years' service in order to learn the business. There was justification for this idea during the period when the development of engineering was so rapid that a large proportion of the men who were turned out from the few engineering schools or the engineering workshops were able eventually to rise to positions of large responsibility and importance, commanding high salaries.

That condition has been altered. Of the men who begin technical engineering work today, only a very few selected ones can rise to positions of responsibility commandnig high salaries. The rank and file must inevitably be ten times as numerous as the captains and lieutenants, and a hundred times as many as the majors and generals.

The man of exceptional ability, indeed, may find it worth his while to work for low compensation because of the future awaiting him. But to hold up to the rank and file of technical workers the idea that they can afford to work for insufficient salaries for the sake of some future high position, which they have not one chance in twenty or fifty of attaining, is a gross deception.

In Public Interest That Engineers Be Well Paid

The committee believes, therefore, that in adopting standards for the compensation of workers in all technical fields due consideration must be given to the great increase in the cost of living which has taken place. The dollar of salary must be considered with regard to what it will purchase today and is likely to purchase next year, and not with regard to the value of the dollar ten or fifteen years ago.

This increase in compensation is necessary not merely as a matter of justice to the engineer, but in order that engineering work may be maintained on the plane that it must be to secure economical and efficient work. Not only the leaders but the rank and file of technical workers often have it in their power largely to affect the cost of the work in their charge by the quality of the effort they exert.

There is no economy in paying such men at rates inadequate for their support, for this leaves their minds burdened with anxieties, when they should be free to give their best efforts to the work in hand. Moreover, such a rate automatically tends to drive the abler men into other occupations and to leave in charge of the work only those of less ability, who are unable to make a change.

The municipal and state section of the committee, Arthur S. Tuttle, chairman, reported that it was formulating a standard classification of positions and duties, and a schedule of titles and qualifications has been prepared to be incorporated in a questionnaire for circulation among engineers of all states and the more important cities.

The Federal Government section, John C. Hoyt, chairman, reported that a survey of Government activities shows 28 offices that employ Government engineers. A letter was sent to each member of the Cabinet requesting a list of engineering bureaus in his depart-

ment, and favorable responses were received from all except the Secretary of War.

The railroad section, Francis Lee Stuart, chairman, reported that a questionnaire had been prepared to be sent to the chief engineers of the railroads under Federal control, but after conference with Director General Hines it was decided to send it to members of the founder societies who are connected with railroads. A letter outlining the work of the committee and suggesting a simple general classification into eight groups accompanied the questionnaire. These eight groups of engineers are as follows:

(1) Chief administrative officer having full charge of organization, including determination of policy; (2) head of major subdivision in responsible charge of large unit; (3) head of intermediate subdivision in responsible charge; (4) head of minor subdivision; (5) on general duty under direction but requiring special education and special training and the use of initiative and originality; (6) on subordinate duty requiring special education or training but not requiring special originality; (7) on subordinate duty not requiring special education, training or originality; (8) on special duty of responsible character requiring particular qualifications and initiative.

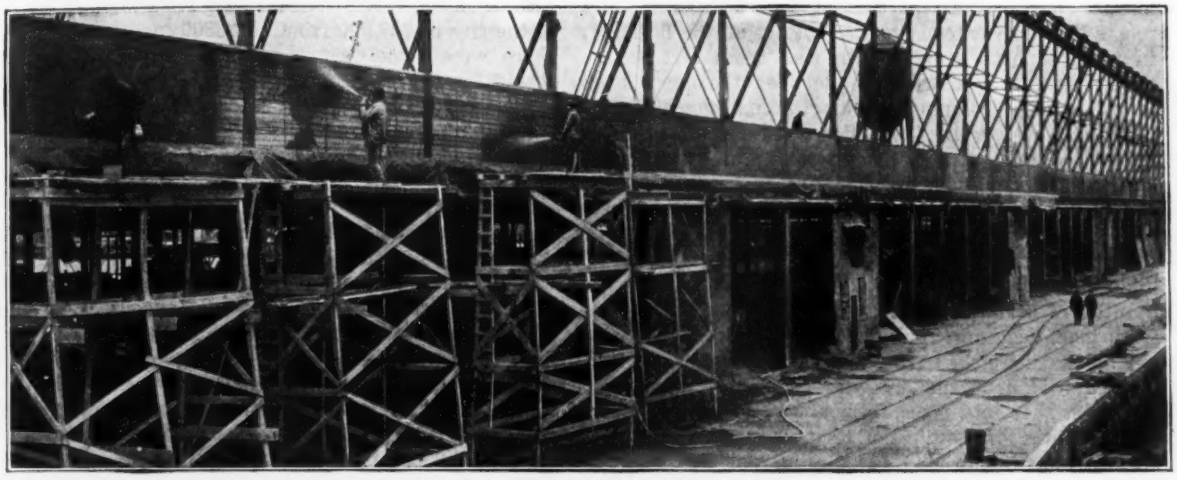
Michigan Is Active in Water Purification

There are now in Michigan 22 chlorination plants, besides 10 filter plants using chlorine, according to a statement by Edward C. Rich, state sanitary engineer. With few exceptions, each installation has a laboratory where daily analyses of the raw and the treated water are made and from which monthly reports are sent to the State Board of Health. Some trouble has been experienced in getting the appointment of competent analysts to take charge of the smaller plants, but the reports from the laboratories are mainly satisfactory. The results in protection of public health are considered to warrant fully the expense of equipping and maintaining these plants and laboratories. The methods recommended by the American Public Health Association are used in the laboratories, and the United States Treasury Department standards for drinking water on interstate carriers are used in interpreting results.

Cement Guns Built Walls and Roof of Army Warehouses

During the War Steel and Timber Framing Covered With Wire Was Coated With Gunite Shot in Place—Materials Transportation Reduced

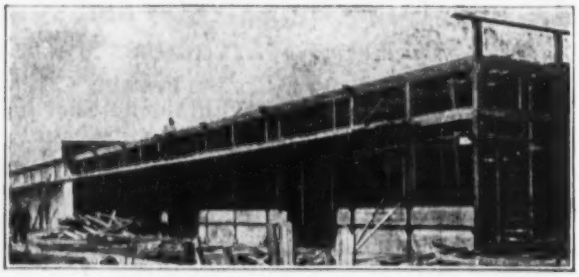
CONCRETE walls and wide roofs were placed with the cement gun on timber and steel frame warehouses and pier sheds on the United States Army Base at Norfolk, Va., during the war, as was reported in an article in *Engineering News-Record* of Mar. 7, 1918, p. 462, although at that time the location of the port was not announced. Land being cheap as compared with that for Army bases in large cities, the warehouse facilities there are provided in the form of large one-story buildings, with a view to securing convenience and rapidity in making up cargoes. On the site of 640 acres there are eight warehouses, serving two piers, the former having nearly 2,500,000 sq. ft. of floor area and the latter having sufficient frontage for 12 large ocean steamers.



CONCRETE FOR SIDE WALLS AND PIER IS SHOT INTO PLACE—THE STEEL FRAMING ABOVE THE WALL IS FOR CARGO-HANDLING EQUIPMENT

Transportation difficulties at the time of construction made it imperative to use local material as far as possible. Sand being plentiful, it was decided to make the walls of 2-in. concrete, with the 1:3½ mixture as placed by the cement-gun process. This was employed for six warehouses, while one has brick and the other has tile walls, the latter being weatherproofed with a stucco coat applied by the cement gun. These buildings are 160 ft. wide and 1400 and 1680 ft. long, with transverse firewalls of brick 140 ft. apart.

Timber framing for the warehouses includes posts spaced 10 ft. on centers, carrying girts and caps and roof joists, the posts having 3-in. plank sheathing with tar and gravel roof. Wire netting of triangular mesh was secured to the posts and girts by wire nails and by wire chairs which kept the netting about ½ in. away from the wood, as described in *Engineering News-Record* of Apr. 25, 1918, p. 819. On the inside of the building are placed wood-form panels about ½ in. behind the wire, and the gunite is shot in place from the outside to build up a wall about 2 in. thick. After 24 hours the panels may be removed and set up for the next section of the work.

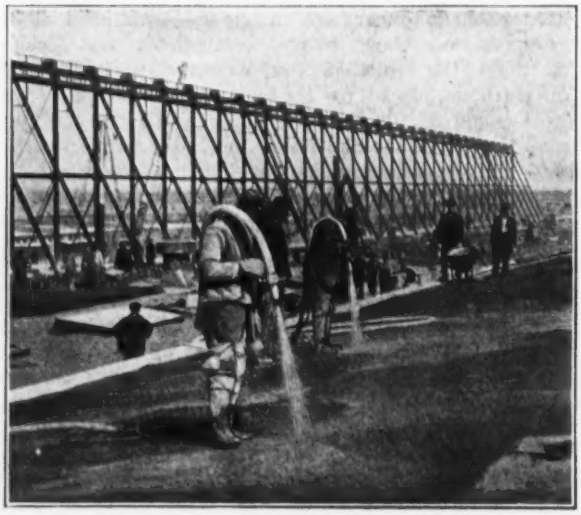


ARMY WAREHOUSES HAVE TIMBER FRAME WITH GUNITE SIDE WALLS AND BRICK FIRE WALLS

Each of the 1280-ft. piers has a steel frame shed in three bays, the middle bay being the higher and forming a monitor. On the outside is a wall extending down about 11 ft. from the roof to the continuous line of doorways, except that at the offices and toilet rooms this wall extends to the bottom of the building. In the side bays every eighth roof truss is cased in concrete to form a firestop. Between the upper ends of the interior columns are longitudinal concrete curtain walls or screens 12 ft. deep, so that smoke from locomotives in the middle bay will not escape into the side bays but will be diverted up to the openings in the monitor. Roof construction of the side bays is similar to that of the warehouses.

Roof construction of an unusual type, for the 42-ft. middle bay, consists of a 2½-in. slab of concrete or gunite on I-beam purlins spaced 7 ft. on centers. Forms were placed close against the upper flanges, and wire netting was stretched from side to side, being supported clear of the beams by wire chairs. The concrete was then shot into place from above, as shown in one of the views. A test panel 11 days old, under a uniformly distributed load of 164 lb. per square foot, showed a deflection of ⅜ in., with slight cracks on the underside. At 209 lb. the deflection increased to 1⅛ in. and the cracks opened. On removal of the load the slab returned to normal position and showed no sign of injury on the top surface.

This work was done by the Cement-Gun Construction Co., of Chicago, which used not only its own equipment but some of that owned by the Dewey Cement-Gun Construction Co., in order to have ample capacity for keeping up with the framing of the building. Sometimes as many as 12 cement guns were at work.



CONCRETE ROOF OF MIDDLE BAY OF PIER IS BUILT WITH CEMENT GUNS

Operation Costs of Municipal Asphalt Plant

Portland, Oregon, Effects Large Saving Over Contract Methods—Plant Pays for Its Cost Three Times in Seven Months

CONSTRUCTING and repairing asphalt pavements with a municipal asphalt plant, during a seven-month working period, from Apr. 27, 1918, has saved the City of Portland, Ore., three times the first cost of the plant, according to the annual report of the city paving department. Comparison of itemized cost with the prevailing contract prices for such work shows a saving to the city of $27,500 from an $8800 investment. While there were some factors, such as advantageous contracts for aggregates which were highly favorable, so large a saving in a time of high wages and high prices for the other materials is thought to indicate considerable saving over other methods at all times. The following data are abstracted from the annual report mentioned above:

Conditions due to the war and high prices for paving work done by contract induced the City of Portland to build an asphalt plant of its own, and specifications were prepared for a plant with a capacity of at least 1000 sq. yd. of 2-in. wearing surface per eight-hour day. The installation of the plant, including the cost of machinery and remodeling and strengthening the dock so as to provide adequate foundation, required about $8800. The plant as constructed has more than equaled the requirements, having turned out between 1000 and 1100 sq. yd. per day on several occasions.

Due to abnormal conditions, it was impossible to procure a new paving plant at a reasonable cost, so a plan was evolved to build it from several separate mechanical units, which could be obtained second-hand from contractors who had closed up their business because of the embargo on materials for public improvements. Care was taken in selecting this equipment to get it in good condition, and the plant as finally constituted is probably as good as a new plant would be, and has been obtained at less than half the cost.

The production of paving material at low cost was aided by several factors: First, on account of the central location of the plant and its proximity to water and rail facilities and sand and gravel bunkers from which these materials could be procured without hauling, cost for material was reduced to a minimum. Second, an annual contract had been made for sand and gravel at pre-war rates. Third, crushed gravel was substituted for crushed rock in the paving mixture, the former being about half the cost of the latter.

On the other hand, the war was responsible for several large increases in the cost of labor and material. The wages of the plant and street crews have increased about 33%, while the cost of asphaltic cement has been about 100% higher than before the plant began operation. It is felt that the conditions which have tended to the increase of the cost of production have heavily counterbalanced those tending toward cost reduction, and that the results obtained have demon-

TABLE I. SAVING TO CITY OF PORTLAND, OREGON, ON CONSTRUCTION ON NEW WORK DURING SEVEN-MONTH PERIOD

Location	Number of Square Yards Laid	Total Cost of Pavement	Cost per Square Yard of Pavement	What Cost per Square Yard Would Be by Contract	What Cost of Pavement Would Be by Contract	Actual Saving Over Contract Work
Terwilliger Blvd.	$22,464.00	$13,972.61	$0.622	$1.43	$32,123.52	$18,150.91
Nicolai Street	1,584.20	1,351.32	0.858	1.43	2,265.41	914.09
Clinton Street	348.63	176.09	0.506	1.43	497.64	321.55
Mulberry Street	628.00	567.09	0.903	1.43	898.04	330.96
Bridges	317.70	392.04	1.234	1.43	454.31	62.27
Crosswalks	3,172.80	3,344.15	1.064	2.00	6,345.66	3,001.50
Totals	$28,514.70	$19,803.29	.....	.....	$42,584.58	$22,781.28

strated that the prices charged for paving under the contract system now in vogue have been far in excess of the actual cost of such work.

An instance of this saving in cost is seen in the surfacing of Terwilliger Boulevard with a 2-in. wearing surface of asphaltic concrete. The contractors' estimate for laying this surface was $1.45 per square yard, exclusive of the cost of grading and scarifying the macadam foundation to a proper subgrade. The work as completed by the city cost $0.693 per square yard, which included not only the laying of the 2-in. asphaltic-concrete top, but also the scarifying and grading work, as well as the crushed rock used in rounding out foundation. The saving to the city on this one job of 22,464 sq.yd. was $18,150, or more than enough to pay the entire cost of two municipal plants of the type built. Table I shows the cost and saving to the city on new construction, during the period mentioned above.

Besides doing the work, the city repaired all cuts made in the pavements for public utilities and took on all maintenance work. On the maintenance work a saving of $3376 was effected, while on the repairing of cuts $1343 was saved. This made a total saving of $27,501 for the three classes of work. The cost of maintenance was reduced from contract prices of $2.87 per square yard to $1.44 per square yard.

The crew required to run the plant consisted of a foreman and three or four men, while the street force consisted of a foreman, a roller man, two rakers, and from three to six laborers. Table II gives itemized costs for the operation of the plant and laying of the pavement, which were under the direction of R. S. Dulin, engineer in charge of the paving department.

TABLE II. ITEMIZED COST FOR OPERATION OF MUNICIPAL ASPHALT PLANT AND PAVEMENT CONSTRUCTION

New Construction Work

Plant Cost:	Total	Total per Square Yard Item	Total per Yard Total
Labor	$2,311.59	$0.081	
Fuel oil	632.51	0.0222	
Coal	99.25	0.0035	
Wood	61.68	0.0022	
Power	106.92	0.0038	
Paving materials	7,169.82	0.2514	
Total plant cost	$10,381.77	$0.3641	$0.3641
Hauling and transportation, including depreciation and interest and repair charge on trucks	2,990.71	.....	0.1049
Street costs:			
Street labor	4,085.71	0.1433	
Street materials	976.68	0.0342	
Total street cost	5,062.39	0.1775	0.1775
Repairs	975.20	.....	0.0342
Overhead: Capital invested in plant, interest on $8,800.00 at 4½%	199.60	.....	0.007
Depreciation (5 years at 20%) ($0.0309 per sq.yd)	881.11	.....	0.0309
Rent	342.17	.....	0.012
Insurance	8.55	.....	0.0003
Superintendence:			
Half time of Chief of Bureau of Standards.			
Full time General Foreman	770.78	.....	0.0240
Miscellaneous charges ($0.0161)	458.24	.....	0.0161
Total cost per square yard	.....	.....	0.7710

PATCHING UTILITY CUTS AND MAINTENANCE

	Cost per Square Yard Top Only	Entire Pavement
Plant labor	$0.1980	$0.5757
Plant material	0.2200	0.6396
Fuel oil, coal, wood, power	0.0382	0.1116
Hauling and transportation	0.2220	0.6472
Street labor	0.3390	0.9880
Street material	0.0222	0.0645
Overhead	0.0600	0.1760
Superintendence	0.0850	0.2470
Total	$1.1844	$3.4496

Cement Joints for Cast-Iron Water and Gas Mains at Vallejo, California

SATISFACTORY experience with the use of cement instead of lead for joints in cast-iron water and gas mains on the Mare Island project of the United States Housing Corporation at Vallejo, Calif., is reported by Philip Schuyler, assistant engineer, in a communication to Stephen E. Kieffer, project engineer, San Francisco, May 26. For a copy of the report, given practically in full below, *Engineering News-Record* is indebted to L. K. Sherman, president of the United States Housing Corporation, Washington, D. C.

The decision to use cement instead of lead was arrived at only after careful investigation of the results obtained in various cities in California during the past decade. The City of Los Angeles, under the direction of Mr. Mulholland, water-works superintendent, was practically the pioneer in the use of cement joints. The Pacific Gas & Electric Co. is now using cement exclusively in place of lead in the laying of all cast-iron mains in various cities in this state, and incorporated its specification in the official specifications for the utilities contract, as follows:

Pipe Joints—Pipe shall first be firmly set and well braced against jar or movement of the joints by careful backfilling between joints and bracing where necessary. Joints shall be carefully wiped out clean and dry. One braid or strand of hemp yarn shall be inserted in joint and very carefully and securely calked. A cement filler, composed of portland cement, with the addition of about 30% of carefully selected, clean, sharp siliceous sand, made into a stiff paste by the addition of water, shall be tightly pressed into the bell to within ½ in. of the face of the bell. A braid or strand of hemp yarn shall then be placed around the pipe against the cement in the bell and calked until the cement filler is firmly packed in the bell. The joint will then be wiped with cement paste, leaving same on a 45° level. The proportion of cement and sand in making paste and its consistency shall be as directed by the engineer. No water shall be allowed in or around pipes until cement is thoroughly set, which shall be determined by the engineer.

The contractor will utilize the services of the employees of Pacific Gas & Electric Co. in the actual work of installing and testing all gas mains and service connections.

Oakum or jute not being satisfactory for use with cement, we decided to use hemp rope, and from the Mare Island Navy Yard obtained some discarded slings made from ½- and ¾-in. tarred rope. These were old, dried out and very stiff, and after being cut into required lengths for our use were unstranded and the strands loosely retwisted and rolled by hand, the thickness depending on the size of joint to be calked. This particular kind of hemp rope proved so satisfactory that the company obtained a quantity for its own use elsewhere.

Great care was taken to see that all pipes as laid were solidly blocked so that there should be no movement of the pipe line during and after the making of the cement joints, and earth was tamped around and over the pipes between joints.

One strand, and sometimes two strands, of the retwisted hemp rope were inserted in the bell of the pipe, and this was rammed in hard by calking. A mixture of two parts cement to one part clean, sharp sand, with enough water added to make a dry paste which when balled and squeezed in the hand would barely exude moisture, was then inserted in the ball, pressed in first by hand until the bell was about half filled, and then calked as a lead joint would be calked, until the calking tool would barely penetrate the cement and the joint would ring. More of the cement paste was then inserted and the calking repeated, leaving the joint filled to within ½ in. of the face of the bell. A strand of the retwisted hemp rope was then laid around the bell, and this was calked in flush with the face of the bell. The joint was then wiped with cement paste containing sufficient moisture to mold, and it was beveled off.

Each joint, after being made, was kept wet by covering with pieces of old sacks, for at least 36 hours, after which the pipe line was slowly filled and allowed to stand under normal pressure, which was never greater than 70 lb., for at least two days, before testing.

Practically All Joints Water-Tight

In the first test 2000 ft. of 10-in. water main and 400 ft. of 8-, 6- and 4-in. pipe were included, and 50% of the joints leaked after they were subjected to the normal pressure. These leaks ranged from a slight sweating to a steady drip which filled the bell holes and covered the pipe. During the following three days most of the leaks stopped, and we decided to cover and backfill the whole pipe line, as the character of the ground was such that any leak would come to the surface, and let the pipe line remain under normal pressure for a week or two before putting on the test pressure of 125 lb. The dry hemp rope undoubtedly absorbed moisture and swelled, thereby stopping all leakage. All leaky joints took up with two exceptions, both of which upon being cut out and examined were found to have been very carelessly made. These were remade, and the line when tested showed no leakage.

A total of 20,770 ft. of 4- to 12-in. cast-iron pipe was laid on this project for water and gas distribution and only six defective joints had to be cut out and remade. When the pipe line could be drained the joint was remade with cement, but a few joints were cut out and remade with lead wool in order not to delay progress.

As it was necessary to pave the streets immediately upon the completion of the sewer, water and gas mains and services, the pipe lines were subjected to a severe test on account of the heavy teaming and heavy steam roller working on the subgrade, but not a single leak developed. The paving was completed in January and the first leak has yet to develop.

To anyone familiar with pipe laying and maintenance, using lead joints, this record should appear remarkable.

So far as we were able to ascertain from observation and cost records, the labor cost using cement joints should be slightly less than for lead joints. The cost of cement and sand per lineal foot on small sizes of pipe is negligible, and the money saved on this project was considerable, as the price of pig lead when this work was started was almost at its highest peak.

Teaming Industries Improve Service by Adopting Motor Trucks

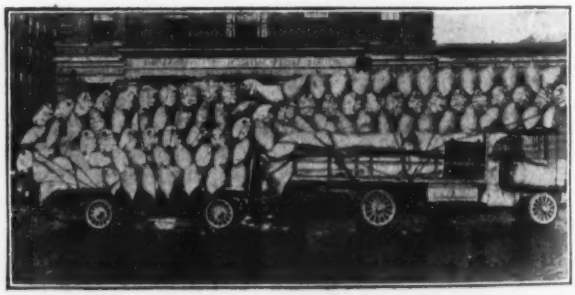
LARGE increases in business and much greater efficiency, both profitable to the teaming companies and more satisfactory to the merchants, have been effected in Boston, Mass., by the substitution of motor trucks and trailers for teams. In one case the tonnage handled by a teaming company was increased 300% in three years. Adaptation of the truck to hauling both heavy and light materials has also been demonstrated in this case.

An example of this expansion is seen in the business of the Youlden, Smith & Hopkins Co., which established its business in 1891 with two horses and a capital of $500. This business increased until, in 1916, five hundred tons of freight were handled daily within a radius of eight miles, an activity which required 150 horses and between 45 and 75 drivers.

In 1916 it was decided to substitute motor trucks and trailers for some of the horses, so as to increase the business by handling tonnage over a larger territory. A fleet of fifteen 5-ton trucks and three 5-ton trailers has been purchased to date, with the idea of supplanting 30 horses. The addition of the trucks has enabled the company to increase its activities so that, during the busy season, it now handles a daily average of approximately 1500 tons of freight within a radius of 30 miles. It is evident that the long-haul business would be impracticable with teams.

Not only has this change benefited the teaming company, but it is found that, due to greater efficiency, the service is more satisfactory to the merchant, who give preference to companies operating trucks. At the present time, only local hauling is done with horses; also, much of this is done with trucks. It is found that each truck purchased replaces four horses, besides increasing both the local and interurban business.

A specially designed Troy trailer, attached to a large truck for the economical hauling of bulky materials, is shown in the accompanying illustration. This trailer



MOTOR TRUCK AND TRAILER HAULING BULKY MATERIAL FOR BOSTON TEAMING COMPANY

has a chassis 16 ft. in length and a capacity of five tons. In the picture it is loaded with sacks of wool. The cab roof of the Mack truck is arranged with an upright so that it may be utilized, and the bags are securely bound on with ropes. While it would seem that in turning there would be trouble with the bags over the coupling, it is stated that no particular difficulty has been experienced, doubtless because there is a large amount of give in the sacks of wool.

Surface Aggregate or Fineness Modulus for Concrete

Professor Duff A. Abrams Defends the Fineness-Modulus Theory of Proportioning Concrete and Gives His Objections to the Surface-Area Theory Proposed by L. N. Edwards

Following the presentation in "Engineering News-Record," of Apr. 17, 1919, p. 758, of an abstract of Bulletin No. 1 of the Structural Materials Laboratory, Lewis Institute, which is an exposition of the fineness-modulus theory of concrete proportioning developed by Prof. Duff A. Abrams, L. N. Edwards, the proponent of the surface-area theory of concrete proportioning, submitted certain comments on Professor Abrams' remarks about the latter theory. This letter and a reply from Professor Abrams are given below. The reply contains some new data from the Structural Materials Research Laboratory, as well as definite criticism of the surface-area method—EDITOR.

Surface Area Method of Proportioning Concrete Is Defended

BY L. N. EDWARDS
Senior Highway Bridge Engineer, Bureau of Public Roads, Washington, D. C.

THE reference in Professor Abrams' article to the surface-area method of proportioning appears to the writer to be subject to question; more especially so, since his own investigations have shown its efficiency for both laboratory and field use.

It is not quite clear just what is meant by the statement, "Our studies have shown that surface area is not a satisfactory basis for proportioning aggregates," since the surface-area method is not confined to the proportioning of the aggregates, but instead is adapted to the proportioning of all the ingredients of the mix, including the water content. Table II of the article above-mentioned does not appear to the writer to offer evidence tending to disprove the fundamental principles of the surface-area method, but rather to add emphasis to the important role of the water content of the mix in the determination of the ultimate strength of the concrete. Incidentally, Table II calls attention to a rather important detail of concrete making to which the fineness-modulus method gives scant consideration.

Granting for the present the correctness of the surface areas as recorded in Table II, then, since the quantities of cement and water were maintained as constants throughout the entire series of tests, it naturally follows that, by reason of the variations existing in the surface areas of the aggregates to be moistened, the quantity of water combining with the cement to form the cement matrix is correspondingly changed. Very small variations in the water content of the cement matrix, at the time of mixing, produce radical changes in its strength, and other physical properties when it has become fully set. "However, it is only the water which goes to the cement (that is, exclusive of absorbed water) which affects the concrete strength." Likewise, this change in the consistency (plasticity) of the concrete is fully recognized in Bulletin No. 1 of the Lewis Institute, but this portion also of the original paper was not incorporated in the *Engineering News-Record* article. Its importance appears to justify its inclusion here:

"The grading of the aggregate may vary over a wide range without producing any effect on concrete strength, so long as the cement and water remain unchanged. The consistency of the concrete will be changed, but this will not affect the concrete strength if all mixes are plastic." The requirement that the concrete be "plastic" when mixed will be referred to further on. However, it may be said here that the above quotation, together with the preceding one from the same source, contains the kernel of the cement-water ratio idea.

Concerning the surface areas recorded in Table II, the writer has endeavored to check about one-third of the entire list. For this purpose unit areas, adapted to Tyler standard sieves, were used. These areas were derived from the writer's tests, described fully in a paper, "Proportioning the Materials of Mortars and Concretes by Surface Areas of Aggregates." (See "Proceedings" of the American Society for Testing Materials, Vol. XVIII.) The fact that a very marked difference has been found between his results and the tabulated areas leads to the conclusion that the latter were determined by a somewhat different method.

For a proposed concrete structure, the consideration of possible sources of supply of aggregates frequently involves the laboratory examination of the concrete-making qualities of two or more different aggregates varying in their sieve analyses and other physical properties. The field condtions attending the mixing, handling, placing and finishing of the concrete, as well as ultimate strength, toughness, etc., of the concrete produceable from them, require that the relative merits of these aggregates be determined under the conditions characteristic of the surface-area method. Most assuredly, those conditions which tend to produce variations in the relative plasticity and the final strength of the cement matrix should be eliminated. In the tests described in Table II, uniformity of strength was the single object sought. Uniformity of plasticity and toughness were not considered.

The writer does not desire to create the impression that the fineness-modulus method is radically different from the surface-area method; on the contrary, he has failed to discover wherein these methods are at variance, although it may truly be said that they approach the problem of concrete design from quite different angles.

Tests Do Not Bear Out Surface-Aggregate Method

BY DUFF A. ABRAMS
Professor in Charge, Structural Materials Research Laboratory, Lewis Institute, Chicago

IN DESIGNING concrete mixtures, three elements must be kept in mind: (1) Workability; (2) strength, or other desirable property, and (3) cost. In usual circumstances, each of these three factors is an absolute limitation on the makeup of the concrete. If cost were no item, concrete of any desired strength and workability could be secured by using rich mixtures. In order to reduce the cost to a minimum, we use as much aggregate as feasible. The degree of workability required depends on the nature of the work and the methods used in handling and placing. The workability of concrete is one of its prime advantages and a certain degree of workability is absolutely essential. In order to reduce to a minimum the cost of handling and placing, a satis-

factory degree of workability may be secured by using a little more water than is necessary, and an aggregate of somewhat greater fineness than that known to produce maximum strength of concrete. In designing concrete mixtures, the engineer must work out a nice balance between the strength, cost and workability in order to secure an economical building material.

It has been pointed out that the function of water in concrete is twofold: (1) To hydrate the cement; (2) to form a plastic mass.

The quantity of water required to hydrate the cement has not been definitely determined; it is probable that not more than 25 to 40% of the water in ordinary concrete is necessary for this purpose.

Tests made in this laboratory have shown that with given materials and conditions of test the quantity of mixing water used determines the strength of the concrete so long as the following conditions are observed: (1) Concrete is plastic with the method of placing used; (2) aggregate not too coarse for quantity of cement used; (3) mixture not so wet that all water cannot be held by the concrete.

Regardless of the size or grading of the aggregate, the amount of cement or the consistency of the concrete, the "water-ratio" may be used as a measure of the strength of the concrete. In other words, it makes no difference *why* the water-ratio is changed; the fact that it *is* changed within the limits stated above produces a definite result. Other properties of concrete, such as wearing resistance, modulus of elasticity, etc., have been found to follow similar laws.

Captain Edwards has not given sufficient weight to the fundamental relation between the water content and the strength of concrete. He states in his original paper that "the surface-area method of proportioning concrete assumes as its basic principle that the physical properties are primarily dependent upon the relation of volume of cementing material to the surface areas of the aggregates." It seems to me that the tests reported fail to bear out this assumption. On the other hand, many different series of tests made in this laboratory have shown that the quantity of cement is *not* a criterion of the strength of the concrete unless at the same time we take into account the quantity of water used. A 1:9 mix may be as strong as a 1:2 mix. In other words, it is the *ratio of water to cement* that determines the strength of the concrete. Table III shows one way in which the quantity of cement may be varied 400 to 600% without producing any appreciable effect on strength so long as the water-ratio is constant. Much greater variations in cement content could have been made had it seemed desirable.

The "water formula" for concrete cannot be reduced to the simple form given by Captain Edwards, if it is to be of general application. The water formula given in Bulletin No. 1 takes account of the following six factors: (1) Relative consistency of concrete (workability factor); (2) normal consistency of cement; (3) the mix (volume of cement); (4) size and grading of aggregate (measured by the fineness modulus); (5) absorption of aggregate; (6) moisture contained in aggregate.

Another term is necessary when an admixture is used. The items, with the exception of (1) and (4) can be readily determined for given materials. The amount of water required under (1) will depend on the nature of the work, the method of placing the concrete, etc. Any method which will give a *proper* distribution of the water due to the size and grading of the aggregate should give satisfactory results. This Captain Edwards has endeavored to accomplish by means of the surface-area factor, while we have used the fineness modulus of the aggregate.

Where the Two Methods Differ

The fineness modulus is the sum of the percentages in the sieve analysis of the aggregate, divided by 100. Sieves from the Tyler standard screen scale are used. The percentages are expressed in terms of the quantity of aggregate by weight or volume *coarser* than each of the sieves. For a particle of a given size the surface area and the fineness modulus bear a direct relation to each other, since they are both simple functions of the diameter. The surface area varies as the square of the diameter, while the fineness modulus is a logarithmic function of the diameter. The relation is not so simple when we come to deal with graded aggregates. The discrepancy in this case becomes so great that both of these methods cannot be correct for a wide range of conditions.

A further discussion of the quantity of water required on the basis of the grading of aggregate may be of interest. The plasticity or workability of the finished concrete is the only criterion which can be used in comparing the water requirements of different mixes, gradings, etc. We have used the "slump" test for this purpose. This consists of molding the 6 x 12-in. cylinder in a smooth steel form by puddling the concrete in 4-in. layers with a ¾-in. steel bar, leveling off with a bricklayer's trowel, then immediately removing the form, without opening it, by a steady, upward pull. The shortening of fresh concrete from its original length, measured in inches, is the "slump."

The water which must be added, due to the presence of the aggregate, aside from that absorbed, may be divided into two portions: (1) To form a surface film on aggregate; (2) to make a thin cement paste which will produce a plastic mix with the aggregate. The total quantity of water required for this purpose can be determined experimentally by measuring the additional water necessary to produce a given plasticity in a concrete mixture as compared with that required for neat cement. By using different quantities of aggregate and different sizes and grading we arrived at the term, $0.30/1.26^m$, in our water formula which takes account of this factor. (It will be noted that this term gives a relation between water and fineness modulus similar to the water-strength curve in Fig. 1 of Bulletin No. 1.) The total quantity of water required for this term in an ordinary concrete mixture is about 8% by volume of concrete, or 40 to 50% of the total. This quantity is known to give satisfactory results. There is no reason why the water necessary to thin the cement paste should not be charged to the cement instead of the aggregate; however, the latter method seems more logical, since it is the presence of the aggregate and its size and grading that necessitate the addition of water to produce a mix of the same plasticity.

How Much Water Does Aggregate Take?

Let us see how much the quantity of water which must be charged to the aggregate (aside from that absorbed) is dependent upon surface area. Earl Pettijohn has shown (*Jour. Am. Chem. Soc.*, April, 1919)

that the thickness of the surface film of standard Ottawa sand is 0.00003 in. at the point when free water begins to form. This means that 18 cc. (about 1/20 pint) of water would be required to produce the surface film on a cubic foot of standard sand and a much smaller quantity for ordinary concrete aggregates. The water required for this purpose is negligible. In other words, practically the entire quantity of water necessary on account of size and grading of aggregates must be charged to thinning the cement paste.

Ordinary mixes require water-ratios of 0.75 to 1.00; the value for neat cement with a normal consistency of 23% by weight is 0.35. In other words, the cement in concrete contains two to three times as much water as that required for normal consistency. It is the dispersion of the cement particles which results from the addition of water that is responsible for the rapid reduction in strength found in the wetter mixes.

How must the thinness of this paste be varied in order to produce a plastic mix with aggregate of different size and grading? Upon thinning the paste by adding water, we observe the following phenomena: (1) Increased plasticity; (2) change in volume.

The increased plasticity arising from adding water needs no demonstration. The volume of paste is first reduced, then increased as water is added to cement. Table I herewith shows the effect with a standard cement weighing 94 lb. per cubic foot:

TABLE I. VOLUME OF CEMENT PASTE

Water-Ratio	Water Added to One Volume of Dry Cement In Terms of Normal Consistency	Volume of Cement Paste
0.35	1.00	0.87
0.40	1.14	0.89
0.50	1.43	0.98
0.60	1.71	1.06
0.75	2.14	1.20
1.00	2.90	1.42
1.50	4.3	1.93
2.00	5.7	2.40
3.00	8.6	3.20

That the *volume* of paste is an important factor in producing plasticity of mix can readily be seen from the fact that plasticity can be increased by increasing the quantity of cement and using relatively less water; in other words, a given degree of plasticity is produced by a low water-ratio for a rich mix and a high water-ratio with a lean mix. Just what effect the actual *quantities* of paste have on workability under the extreme conditions of mix, etc., has not been determined.

Current theories of concrete are generally based on the idea that the quantity of paste is dictated by the voids in the aggregate, with a certain surplus. Four weaknesses in this theory may be mentioned: (1) The voids in the aggregate can be varied widely without producing any change in the quality of concrete; (2) the grading of aggregate which gives greatest strength in concrete gives higher voids than are found in other gradings of lower strengths; (3) concrete of highest strength may contain visible voids; (4) the strength and other desirable properties of the concrete depend on the *quality* of the paste and is little affected by the *quantity*, so long as we have sufficient to produce a workable mix.

The influence of the cement-water mixture on the plasticity of concrete is, then, a function jointly of the plasticity and volume of the paste. We have seen that the strength is a function of the water-ratio (volume of water to volume of cement) and that the strength of concrete decreases as the water-ratio increases; hence, in order to secure the highest grade of concrete at the lowest cost it is necessary to secure a given condition of plasticity with a minimum water-ratio. What condition with reference to the size and grading of the aggregate will give the desired result? It is obvious that this is a most complex relation if we consider the almost infinite variety of sizes and gradings which may be made from a single aggregate. Captain Edwards has used the surface areas as a satisfactory measure. It seems to the writer that the radius of curvature of the particles and the number of points of contact (or near contact) between adjacent particles are the factors which are primarily responsible for the additional water which is necessary due to the presence of the aggregate. Both of these factors are functions of the diameter; the radius of curvature is one-half the diameter if we assume that aggregate of spherical form is being used. Since particles of all sizes are mixed at random, and there is no systematic arrangement, it is impossible to analyze the problem in a way that will enable us to compute the number of points of contact. The only practical method, then, is to determine the relation by trial. The fineness-modulus method was arrived at in this way. It was discovered from a study of mortar strength tests of about 1000 different sands mixed to a uniform plasticity, and stored and tested under uniform conditions.

The water formula given in our Bulletin No. 1 is of a rational form and can be applied to any combination of concrete materials. Its development was an evolution extending over several years. These formulas were numbered in the order of their derivation as they were modified from time to time on the basis of experience. The above formula is No. 11. It is based on the experience of many thousand tests. I do not mean to be understood as believing that this formula is exact and will require no further modification. On the other hand, subsequent experience may dictate certain changes.

The formula has been subjected to many severe tests by applying it to aggregates of the most diverse character. A recent series of tests using four different coarse aggregates (graded No. 4 sieve to 1½ in.) and the same sand gave the following results (Table II) for 1:4 mixes:

TABLE II. STRENGTH OF CONCRETE FROM FOUR AGGREGATES

Coarse Aggregate	Compressive Strength (Pounds per Square Inch)
Pebbles	3,620
Crushed limestone	3,830
Crushed slag	3,750
Crushed granite	3,850

Tests were made on 6 x 12-in. cylinders at the age of three months. Twenty-one different gradings were used for each coarse aggregate. Specimens were stored under two conditions. Each value given above is the average of 105 tests. The water for these concretes was proportioned by the formula given above. The fact that with similar gradings and water properly controlled we secure uniform plasticity and strength is a severe test of the formula, when it is considered that we are comparing spherical and crushed materials of widely different characteristics. The absorption of the aggregate was also different in each case. Many serious errors have been made by experimenters in comparing the concrete-making qualities of different aggregates. The wide variations reported in the strength of the concrete made from different materials can almost invari-

ably be traced to failure to take account of differences in size or grading, and to neglect of the absorption of aggregates.

The sand-mortar tests in Captain Edwards' paper, which were mixed with 1 volume of cement for each 13 sq.in. of calculated surface area of the sand, gave mortars of fairly uniform strengths at three different ages. These tests are interpreted as proving that the surface area of the aggregate is a proper basis for proportioning mortar and concrete mixtures. It is the writer's view that the uniformity in strength is due to an entirely different cause. Since both the water and cement were proportioned on the basis of the surface area of the aggregates, he obtained a uniform water-ratio, which is solely responsible for the uniform strength. This is the result to be expected so long as all of the mixtures were plastic and none of the aggregate gradings was too coarse for the quantity of cement used.

Tests Do Not Check Surface Method

It is unfortunate that it was not feasible to include in our Bulletin No. 1 all of the data on which the conclusions were based. It is the writer's belief, however, that the tests given in Table 2 of the bulletin bring out a fatal limitation of the surface-area method of dealing with proportioning of aggregates. Twenty-seven different gradings of the same aggregate were used. The gradings were made to vary over a wide range, but had one property in common; that is, the fineness modulus was uniform. They were mixed with the same proportions of cement and water. The strengths for two different consistencies showed a mean variation from the average of about 3%, and a maximum variation from the average of about 10%. The corresponding values for surface areas are 34% and 110%, respectively. If the water proportioning of these tests had been based on Captain Edwards' formula the water-ratios of the concrete would range from 0.39 to 0.57, an extreme variation of 69%, and would have made a very great difference in the plasticity of the concrete. It is true, as stated in Captain Edwards' letter, that these tests were made with a view to determining whether or not a uniform strength of concrete was obtained with such wide variations in the sieve analysis of the aggregates. However, the plasticity or workability of the concrete did not differ materially.

The surface-area values in our table were calculated from the diagrams given in Captain Edwards' paper. It was necessary to estimate the areas of the sand particles below the 100-mesh sieve, and wide variations may be due to this cause. In certain of the tests as much as 10% of the aggregate was sand finer than the 100-mesh sieve. The surface area of this portion which we must estimate or neglect entirely is probably considerably greater than the entire surface area of many other gradings in the same group. The quantities of water given by Captain Edwards' formula are only 60 to 70% of those required for the materials used in this laboratory. It was impossible to mix concrete using the water given by his formula.

Table III herewith gives the results from a portion of some recent tests in this laboratory. Two leaner and two richer groups of mixtures are omitted. The quantity of materials required for each specimen, beginning with the 0-1½ in. aggregate and a mix of 1:2½:5, 1:2:4, 1:1½:3, etc., was calculated. The coarser sizes of aggregate were dropped in turn, but we retained exactly the same quantity of cement and water. The final mixes in terms of volume of cement and total aggregate are given in Col. 2 of the table. It is obvious that the richer mixes in each group are much more plastic than the leaner ones, and that equal workability was not secured. As in all other tests in these investigations the concrete for each cylinder was mixed separately by hand. Each value is the average of five tests made on various days. The second series of tests is not yet completed; however, the tests which have been made show a greater uniformity in strength than those in Table III, due to slight readjustments of certain constants in the water formula. These tests confirm the conclusion based on many other series; Namely, that *the widest variations may be made in the mix, consistency, and size of aggregate without any change in strength so long as the water-ratio is unchanged,* and the above limitations are not violated.

It seems to the writer that any comparison of the surface-area and fineness-modulus methods must be reduced to the following two factors: (1) Which rests on the more sound experimental basis? (2) Which is the more simple to apply?

As stated above, the whole question of the comparison between the two methods resolves itself into that of determining which will give the better distribution of water in a mix, so far as the size and grading of the aggregates are concerned. Both of these methods make use of the sieve analysis of the aggregate. However, it seems to the writer that there is more variation in the underlying principles than that suggested in the last paragraph of Captain Edwards' letter.

It appears to the writer that the following disadvantages accompany the use of the surface-area method: (1) Areas of the finest particles of sand cannot be computed; (2) crushed aggregate requires a greater quantity of water for the same grading than pebbles of a spherical form; (3) if the surface-area method were strictly interpreted it would require separate treatment for practically each kind of aggregate; (4) the method requires laborious computation, with the resulting chance of error; (5) it is not clear how the method can be applied to the simplest problems which arise in the course of designing concrete mixtures; for instance, to determine the best proportions of given fine and coarse aggregates for a concrete mixture; (6) it has not been shown that there is any theoretical reason why the surface-area method gives more nearly correct results than other methods which have been proposed.

If the surface-area method is correct, it would seem to be a serious fault that the areas of the finest particles cannot be satisfactorily dealt with. It seems probable that in extreme cases the areas of the particles finer than the 100-mesh sieve would be in excess of the combined areas of the coarser sizes.. Our experience indicates that the quantity of water required for these fine sands is not in proportion to the amount that would be suggested by the surface areas.

The area of a tetrahedron is 25 to 30% greater than that of a sphere of the same volume, or one having a diameter equal to the height of the tetrahedron. Our experience in testing concrete made of crushed aggregates as compared with rounded pebbles does not indicate that there is any discrepancy in the quantity of water required, as would be suggested by the surface-area method.

TABLE III. EFFECT OF SIZE AND GRADING OF AGGREGATE AND CONSISTENCY OF CONCRETE

Compression tests. Six by 12-in. cylinders, hand-mixed concrete.
Age at test, 28 days. Stored in damp sand; tested damp.
Sand and pebble aggregate. Each value is the average of five tests made on various days.

		—Water—		—Aggregate—				—Surface Area—		—Concrete—			
Ref. No. (1)	Mix by Volume (2)	Relative Consistency (3)	Ratio to Cement (4)	Size, Inches (5)	F.M.* (6)	Weight, Pound per Cubic Foot (7)	Density (8)	Square Inches per Pound of Aggregate (9)	Square Inches per Pound of Cement (10)	Weight, Pound per Cubic Foot (11)	Density (12)	Yield† (13)	Compressive Strength Pounds per Square Inch (14)
				Nominal Mix for 0–1½-inch aggregate, 1:2½:5									
15	1:6.7	1.00	0.91	0–1½	5.67	125	0.755	923	8280	152	0.846	0.978	1640
16	1:5.4	1.05	0.91	0–1	5.09	124	0.743	1052	7500	151	0.828	1.006	1800
17	1:3.7	1.13	0.91	0–¾	4.10	121	0.725	1737	8300	145	0.768	1.115	1760
18	1:2.5	1.21	0.91	0–4	2.99	112	0.671	2601	7750	139	0.696	1.241	1950
19	1:2.2	1.23	0.91	0–8	2.58	108	0.648	3056	7730	136	0.669	1.299	1630
20	1:1.9	1.29	0.91	0–14	2.24	105	0.629	3695	7840	134	0.643	1.377	1940
21	1:1.2	1.50	0.91	0–28	1.81	102	0.611	4494	5860	135	0.603	1.685	2000
												Average	1820
				Nominal Mix for 0–1½-inch aggregate, 1:2:4									
22	1:5.4	1.00	0.80	0–1½	5.67	126	0.755	923	6680	152	0.842	1.003	2230
23	1:4.3	1.05	0.80	0–1	5.09	124	0.743	1052	5980	150	0.814	1.050	2130
24	1:2.9	1.13	0.80	0–¾	4.10	121	0.725	1737	6480	144	0.754	1.183	2550
25	1:2.0	1.20	0.80	0–4	3.00	112	0.671	2604	6210	139	0.690	1.322	2160
26	1:1.7	1.22	0.80	0–8	2.58	108	0.648	3056	5970	136	0.658	1.418	2280
27	1:1.5	1.26	0.80	0–14	2.24	105	0.629	3695	6180	132	0.625	1.522	2440
28	1:0.9	1.47	0.80	0–28	1.81	102	0.611	4494	4390	135	0.594	1.937	2400
												Average	2310
				Nominal Mix for 0–1½-inch aggregate, 1:1½:3									
29	1:4.0	1.00	0.69	0–1½	5.67	126	0.755	923	4950	152	0.832	1.054	3100
30	1:3.2	1.04	0.69	0–1	5.09	124	0.743	1052	4450	149	0.799	1.120	2970
31	1:2.2	1.11	0.69	0–¾	4.10	121	0.725	1737	4930	144	0.743	1.273	3390
32	1:1.5	1.16	0.69	0–4	3.00	112	0.671	2601	4650	139	0.679	1.463	3270
33	1:1.3	1.20	0.69	0–8	2.58	108	0.648	3056	4570	136	0.651	1.570	3220
34	1:1.1	1.22	0.69	1–14	2.24	105	0.629	3695	4540	132	0.615	1.740	3200
35	1:0.7	1.37	0.69	0–28	1.81	102	0.611	4494	3410	129	0.565	2.308	2930
36	1:0	1.92	0.69	....	Neat	...	....	....	....	132	0.467	.....	3230
												Average	3160

* Fineness modulus of aggregate.
† Yield was calculated on the basis of the original volume of dry aggregate.

The computation of surface-areas begins at practically the same point where the determination of the fineness modulus ends. There appears to be little room for question as to which of the proposed methods is the more simple in application.

No doubt, the surface-area method could be worked out so that it would apply over a limited range. In fact, almost any function of the size of particle could be used in this way. This would be equivalent to representing a portion of the curve by a line or by an arc of different curvature.

It is unfortunate that the wording in our Bulletin No. 1 was such as to permit the interpretation which is placed upon it by Captain Edwards in the third and fourth paragraphs of his letter. The thought the writer meant to convey was not at all the meaning that Captain Edwards finds in this report. The purpose was to indicate that the *size* of the aggregate may vary over a wide range without producing any effect on the concrete strength, so long as the concrete and water remain unchanged; for instance, as in Table III, herewith. The confusion arises from the use of the term *size* and *grading* interchangeably and to the use of both of them in a multitude of different senses. It was not intended that this statement should apply to the case of aggregates having the same fineness modulus, such as those given in Table 2, Bulletin No. 1.

Correction in Writer's Title

H. Y. Carson, lately captain and sanitary engineer, American Red Cross Commission, author of the article "Ancient, War-Time, and Present Water-Supply in Jerusalem," *Engineering News-Record* of June 5, 1919, p. 1092, is now with the American Cast Iron Pipe Co., Birmingham, Ala., and not with the Central Foundry Company, as indicated incorrectly at the head of the article.

New Etching Process for Studying Structure of Steel

Does Not Require Polished Surface, But May Be Used With Emery Finish—Prints Made by Ink and Copying Press

A USEFUL improvement in methods of etching sections of steel to study the quality and internal structure of the metal has been made by J. C. W. Humfrey of Sheffield, and is reported by him in a paper read last month before the Iron and Steel Institute, under the title "Macro-Etching and Macro-Printing." The value of the method lies in its ease of application; instead of requiring a finely polished surface to prepare for the etching (with present methods a coarser-grained surface is not adequate, in view of the delicacy of the etching) it can be applied to surfaces having an emery-paper finish only. Furthermore, the etching gives such a degree of relief that prints can be made by means of printer's ink and copying-press methods. Specimen prints included in the paper just mentioned show that the marks traced out by the impurities in the steel which give rise to the differences of etching are sufficient to portray the mechanical structure of the metal very perfectly. Thus, ingots, punched shell blanks and the like show clearly defined structure markings.

Humfrey's etching solution is a modification of Heyn's reagent (copper ammonium chloride) made by adding strong hydrochloric acid. The most satisfactory composition was found to be 120 g. of copper ammonium chloride, 50 cc. of concentrated hydrochloric acid and 1000 cc. of water. This solution is poured on the surface to be etched, which is placed horizontal, and is renewed frequently, so that a film of fresh solution is always in action. A satisfactory relief effect is obtained in from 20 min. to one hour.

It is preferable to start the etching with a neutral

solution and continue with it until the emery-paper scratches are all eaten away. Then, in successive applications of the acid solution, the acidity of the reagent is gradually increased up to the maximum. By starting with neutral solution, the copper which is thrown down on the iron is given a loose or flocculent nature, so that it can be wiped away, while the acid solution tends to produce an adherent plating of copper. For this reason, whenever the solution and the copper are wiped off for the purpose of examining whether a sufficiently deep etch has been obtained, the etching is started again with the neutral solution, subsequently acidified in successive stages.

When a surface so etched is inked with a printer's roller a print can be made from it in a copying press. Coated paper and a rather hard pad give the best result.

The effect of the acid solution is to attack most vigorously the purer parts of the metal, which solidified first. All areas containing marked amounts of impurity are more resistant to the reagent and show on the finished plate in high relief. The chief impurity having the effect of increasing the resistance of the steel to the etching fluid is phosphorus, and in a sense the prints obtained are maps of phosphorus distribution in the metal, just as bromide-paper prints give maps of the sulphur distribution.

Presidential Address at Convention of Civil Engineers

Fayette S. Curtis Outlines the Duties of the Engineer and Reviews Past Accomplishments—Promises for the Future

DIGRESSING somewhat from the trend of former addresses, Fayette S. Curtis, in his presidential address June 17 at Minneapolis, Minn., at the first convention of the American Society of Civil Engineers held after two years' interruption by the war, spoke of the duties of the engineer, what has been accomplished in the past by the society and what is to be accomplished in the future, the personal application necessary to make work successful, and the distinction to be gained through uprightness and honest labor. The address, practically in full, follows:

It is quite probable that some of you have often been asked the question, "Do you recommend civil engineering as a profession?" and I assume that generally an affirmative answer has been given. The civil engineer, when thoroughly fitted for his profession, immediately becomes useful to society and the world of materiality. He is prompted by the wants of society, and is constantly originating other wants by the improvements he introduces. He is also creative, and his profession is not mortgaged to power or influence, but stands firmly on its own foundation—encouraged by world-wide influences.

His duty consists in designing, arranging, and building structures or machines which require the immediate superintendence of those who are acquainted with not only the principles but the practice of construction; for engineering is a branch of knowledge that takes its place both among the sciences and the arts.

Therefore, to be eminent in his profession, or any branch of it, he should be able, not only to design and plan, but to supervise construction. Those who have only the knowledge of how to design and plan, and are unable to execute, become confused in meeting the many contingencies which arise.

Requires Acquaintance With Sciences

The profession, embracing as it does almost every kind of construction, requires a very extensive and general acquaintance with other sciences, in order that the engineer may be qualified to accomplish successfully the various works on which he may be engaged, and to overcome those difficulties which frequently arise unexpectedly in the progress of his work, and, but for that knowledge and talent, threaten its final success.

Thomas Telford, in his "Descriptive Narrative of his Professional Labours," has said:

"How can a man give judicious directions unless he possesses personal knowledge of the details requisite to effect his ultimate purpose in the best and cheapest manner? It has happened to me more than once, when taking opportunities of being useful to a young man of merit, that I have experienced opposition in taking him from his books and drawings, and placing a mallet, chisel or trowel in his hand, till, rendered confident by the solid knowledge which experience only can bestow, he was qualified to insist on the due performance of workmanship, and to judge of merit in the lower as well as the higher departments of a profession in which no kind or degree of practical knowledge is superfluous. For this reason I ever congratulate myself upon the circumstances which compelled me to begin by working with my own hands, and thus to acquire early experience of the habits and feelings of workmen; it being equally important to the civil engineer, as to naval or military commanders, to have passed through all the grades of their profession."

It is no doubt true that many men have gained prominence in their profession by individual effort—practicing and studying at the same time, with a view to acquiring a full knowledge of all necessary scientific principles. Students are required to spend a certain time in acquiring technical knowledge, but must not then think they are engineers in the broad meaning of the term, capable of constructing and being responsible for engineering work, as that is a false idea.

No one can doubt that the addition of the natural sciences to the old-time arts course has greatly enriched it, and the sciences are now undoubtedly the most important part of a liberal education; but there is another side, which we cannot ignore, and that is, that, after all, the great object of a good education is not so much the accumulation of knowledge as the development of mental power in the individual.

The tendency toward scientific and practical education is no new thing. Men have come to see that the first mental training can be made more effective by solving physical problems than by studying the dead languages, because as much true value can be obtained in the study of nature as in the study of man's conception of nature. First knowledge is more satisfactory to the best of minds.

Specialization Necessary

The profession has become so diversified that after having secured a good fundamental training it would be worth serious consideration to take up a single branch of engineering practice, as it can hardly be expected that the civil engineer will become proficient in every branch. He would be better able to give his best endeavors to attaining the highest proficiency in some particular line, and, at the same time, grasp or understand in a general way the subjects which may relate to the several kinds of works, as the whole subject is so broad that it would be vain to attempt to understand them all in all their details.

Ambition to obtain as great a knowledge as possible is to be admired and encouraged, but to attain the highest standard in one branch is more commendable than to attempt to reach special eminence in all, as the student will be apt to find himself oppressed with a weight which he is not capable of sustaining, and this will be very likely to result in utter failure.

The professional man should not make the mistake of thinking that he can reach the top in an unconcerned and idle manner, believing that by some easy process he will

reach and hold it. The structure on which he stands must be constructed by piece and parcel, every member thoroughly tested by a gradual and difficult process; he must experience all the difficulties, trials, and troubles to be met on the way, in order to support and sustain him at the higher elevation to which he aspires. To such the doors to success are open. Work seeks the best hands, as naturally as water runs down hill, but seldom seeks one whose only recommendation is that he needs it. If he is not willing to go slowly through the maturing process of time, through patient work, by steady application step by step preparing himself for the work ahead, which has made men prominent and efficient in their profession, then, alas, the result is doubtful. It is like the student who prepares his education for future advancement. He goes from grade to grade until he is master of the science on which he has to build, taking no upward step until the last has been tested and found not wanting in any characteristic which will sustain him and serve him to build on for the future.

Facing New Conditions

New problems are all the time arising. The tremendous growth of our complex industrialism means the facing of new conditions, that we may overcome new difficulties and enjoy new benefits. Therefore, there is only work to face, and it should be met with a spirit characteristic of the creator of science, and thereby much may be accomplished.

There is no success without hard and earnest labor. Never balk at a few obstacles, but hang on with all your might; this, in the end, will give success. It is true that many experiments will have to be made, but there can be no doubt of ultimate success if our aim is a determination to succeed and we do not become discouraged.

As we look back, even over a short time, how often have we said to ourselves, after completing some important structure, "This should last for many years—we have reached the limit;" but within a comparatively brief period have we not seen that structure replaced by another, larger and more expensive, which has been demanded by the growth of business? We have not stopped building, nor have we come to the time when we have built sufficiently for the future, and we never will, as long as the richness of this country is undeveloped and its physical and financial growth continues. To stop this great advancement, which the people continue to make, would be death. Then, does it look as though there was not a future for the engineer who has integrity and perseverance, as he is and must be the practical foundation or basis for all which we are to build, in order to accomplish a higher and nobler position in society?

The work of the engineer is the foundation on which rests the growth of this great republic, not only physically but financially. He is one of the prime factors, and could not by any possibility be dispensed with. We are not an organization which threatens to pull down and wreck or destroy what we have built, but an educational organization, and hope to get the necessary recognition of our rights through education. No doubt the engineer has often had his line of procedure curtailed by some power having authority to suspend or discharge at will, at the pleasure of some controlling power, ignorant, and with no understanding of the conditions or the difficulties the engineer may have to meet, and without the least knowledge of engineering subjects.

Civil engineering is ages old, but has always shown a steady progression, possibly not as to more substantial work, but certainly in the facilities provided in machinery to do its work. As to its beginning, I will not undertake to say, but will only refer back to those times of which we may have knowledge, and ask if the great work done is not a credit to the scientific ability of this profession? But what is the future to be? Does it depend on those who are coming into this society—educated, experienced—to show to the world that they can and will continue to build and improve the financial and social conditions? For a determination we must wait on time.

Is the engineer being benefited by his connection with this society? It has been said that the society is becoming less democratic and more conventional, or, in other words, is not taking sufficient interest in, or having proper regard for, its members, and, therefore, they are without the opportunities or advantages which they might gain in local societies. This society has grown to such an extent that contact personally with all its members is not possible, but the interest and devotion and brotherly love of its members are just as great as ever. The information in the different papers by the most prominent engineers of the country, presented and distributed, is of the greatest importance to the members of the society. As the society grows, this information increases, and the papers are more numerous and contain information and knowledge which cannot be obtained except through the parent society. If not, why are so many engineers anxious to affiliate themselves with this society? They know it gives them prestige the world over, and sets a standard which has been passed upon and approved by the highest of professional men. Our constitution requires that standard to be higher than that of any of the local societies.

The society has not only grown in numbers, the increase within the last ten years being 85%, but has increased in influence in the estimation of the public and the world at large; our members are looked up to as the leaders in the engineering profession. Then, who can say that it, as an engineering society, has depreciated, gone back, or fallen off one iota from its former standing? On the contrary, it has grown steadily stronger and stronger. Its members have become of such strength, in the material and financial upbuilding of the Government, that they are indispensable.

Therefore, we must not permit ourselves to forget the obligation we owe to the founders of this society, the men who gave their time and talent in creating an organization which has proved to be of untold benefit to the engineering profession. How, then, are we to repay them, if not by giving to the society our support and assistance, promoting good fellowship among its members, encouraging its officers, and giving a helping hand to the future engineer who comes into the society, passes up through the different grades of experience, and is seeking information? Let us all do something in the interest of the society, and thereby broaden its influence and add to its high standards of proficiency.

We certainly cannot help by creating dissensions among the members, or becoming dissatisfied with the earnest labors of those whom we select to bear its responsibilities, or in getting the idea that we are connected with this society wholly for what we can get out of it. No matter how much we give, we can never repay the society for the benefits we have received.

Future of High Honors Possible

The engineer has designed and built many a monument which will endure for ages as a testimonial to his proficiency and skill. We need not go back many years to find members who have won the highest engineering distinction and whose names are ineffaceably engraved on the enduring pages of history. We know who they are and what they have accomplished. Even before this society was organized, we find the names of engineers who achieved everlasting remembrance through their exceptional ability. Therefore, I would say to engineers, but more particularly to the younger members of the profession, that there is a future for them which, if taken advantage of, will insure the highest honors possible to be obtained.

By him who is in the prime of life and in the possession of health, strength, and knowledge of the arts and sciences, much may be accomplished. Therefore, never give up. Think, work and suffer, that in this life you may gain something which will place your name upon the highest pinnacle of fame.

Many of our members have been engaged in the late war, and their work, in the construction of yards, docks, cantonments, and the reconstruction and building of bridges, roads and equipment, both in this country and on the other side of the Atlantic, thus making it possible to take care of millions of troops, was the most important factor in bringing the war to a successful termination. All of this has been done in such short time as to bring out comment and praise from the whole world. Why should not the

engineer have his full due and credit for the ability he has shown, not only at critical moments during the war, but in the accomplishment of things at other times?

We are living in an age in which we possess all the information as to what has been done for many years, all of which we ought to profit by. The conditions change, the opportunities grow greater. This world is growing in its necessities almost beyond the imagination of the present generation. The country is being developed so that every state in the Union is increasing in wealth and prosperity. Greater facilities are needed to accommodate its growth. And yet some say there is no future!

Work of Other Societies

The work of other engineering societies or organizations should also be mentioned. They have all done their part in building and developing the great industries of the world. All are working toward the same purpose, creating, building, and improving the facilities on which the prosperity of the country depends. This is illustrated by the establishment of Engineering Council, composed at present of representatives of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the American Society for Testing Materials, for the purpose of giving more strength to the profession and obtaining greater recognition for the engineering arts and sciences.

Why should we not go farther, and even take our position in Governmental affairs? Is it the political cloud that casts a shadow over us, so that our practical ability does not get the proper recognition in Government affairs; or is it our modest, indifferent way of being satisfied with our present condition? We should rise to the occasion, demand our rights, and a proper recognition by the people generally, with the idea that we are not only to advance the engineering arts and sciences but to fill the positions under this general Government which require the knowledge of how to govern, each according to his ability.

The armistice having been signed, it is incumbent on us, as founders of prosperity, with the sciences and the arts, to become one of the greatest upbuilding factors in the future, to help reconstruct that which has been torn down and destroyed by the ravages of war, and to promote new ideas for the world's future prosperity.

Emerging from the greatest war the world has ever known, not only in the number of men engaged and the use of the most deadly weapons, but in the destruction of property, what does this mean for the future? The employment of many engineers to reconstruct, and to rebuild in an improved form.

In the future the names of many of you engineers will be enrolled among those who have attained high public standing through great achievements. Many in our profession have thought, done, and suffered much in former days. Childhood may seem to be at almost an immeasurable distance in the past, but something that we have accomplished on account of its overpowering vastness seems near. It is like a beacon light, far away but seemingly near.

It is said, "The schoolhouse of the world—human experience—however expensive, has something to teach." Shall we learn our lesson readily?

Snowslides Removed by Sluicing

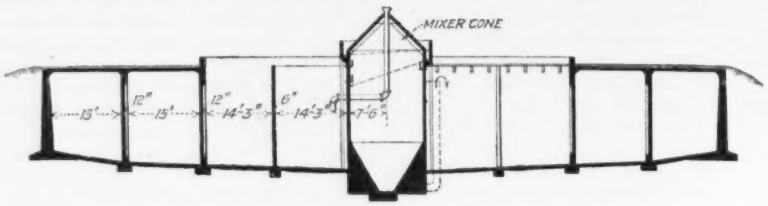
Three snowslides which blocked the line of the Government railroad in Alaska between Anchorage and Seward were to be removed by sluicing, according to the *Alaska Railroad Record*. One of the slides was 25 ft. deep over the track and the other two were 50 ft. in depth, the locations being at Mile 76½ and Mile 72, respectively. Nearby streams flowing only during the melting of snow in spring were available for removing blockades.

Combined Aërator and Mixer for Colloidal Water

Odor, Color, Taste and Turbidity in Underground Water From Cavernous Limestone Make Treatment Difficult

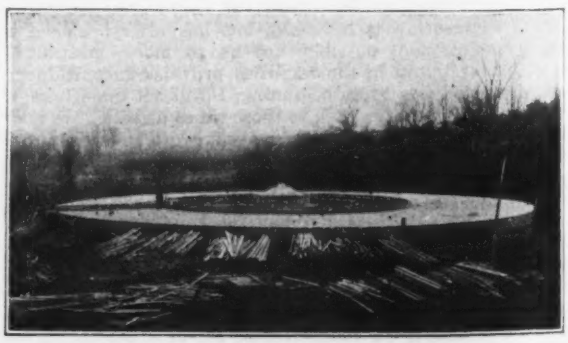
HIGH colloidal content and infrequent heavy turbidities are removed from the water-supply of Bloomington, Ind., by a combined aërator and mechanical mixer consisting of a conical concrete framework in which are embedded a series of short angles interrupting the flow.

Geological conditions have made the water-supply problem particularly troublesome, the city being in the Mitchell limestone district, which is cavernous and underdrained to such an extent that deep rock wells are practically impossible, while the numerous fissures make the impounding of a sufficient supply difficult and uncertain. After numerous attempts to impound the water of several small streams in the vicinity, and after giving consideration to pumping water from White River, nine miles distant, a reservoir was constructed on a suitable site about three miles from the present pumping station. This reservoir is supplied entirely by springs and underground streams and has an approximate capacity of 1,500,000 gallons.

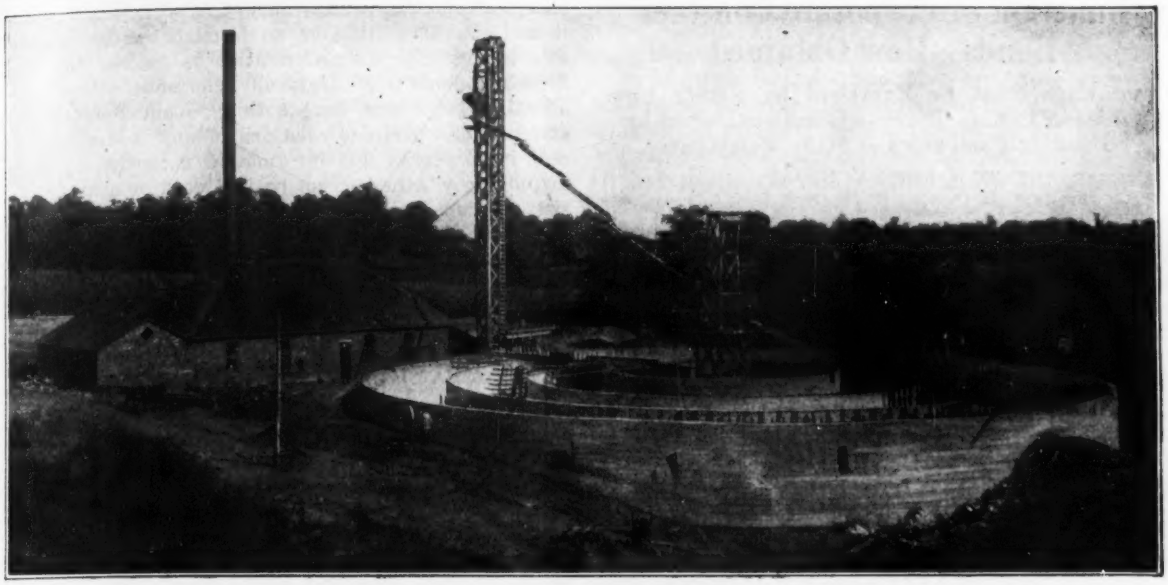


SECTION THROUGH BLOOMINGTON SETTLING RESERVOIR

The conditions in this reservoir, together with a high iron content in the water, favor the production of organic growths, which during certain seasons give objectionable odors and tastes. This feature, coupled with the fact that at times of extremely heavy rainfall the underground streams carry considerable turbidity, made it necessary to provide a purification system and means for the removal of the tastes and odors. Experiments showed that with complete aëration and the use of chlorine gas, followed by coagulation, a satisfactory effluent could be obtained. With the high colloidal matter and periodical heavy turbidities, it was considered advisable to provide not only the treatment just indicated but also to construct a specially designed sedimentation basin in connection with a small storage



CONE MIXER IN OPERATION



CIRCULAR BAFFLED RESERVOIR CONCRETED BY TOWER AND CHUTE

reservoir, having ample means, while in service, for removing settled solids. The combined reservoir and basin is of reinforced concrete, circular in form, 140 ft. in diameter, the outer ring, 30 ft. in width, being covered.

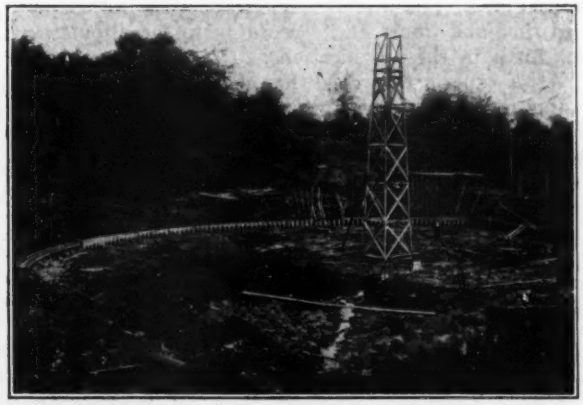
The combined aërator and mechanical mixing chamber is the special feature. The aërator, which is constructed of reinforced concrete, is formed in the roof of the circular mixing chamber. It is conical in shape, 16 ft. in diameter, and has a slope of 37½°. Water is discharged from a pipe rising just above the apex of the cone, and sprays down over the conical surface, in which are embedded a series of short angle irons which are set in such a way as to increase the splashing effect and to give the water a circular or spiral motion.

This additional length of travel not only gives a more complete mixing effect but considerably increases the contact period. The water falling over the edge of the conical surface flows into an inclined circular gutter or trough, to augment the circular motion as it passes into the water of the mixing chamber, which is located in the central compartment of the basin (see drawing). This arrangement, with the method of discharging the water from the chamber, creates a high velocity which gives a complete mechanical mixing of the coagulant, this being added in solution at the beginning of the operation. The contact period is from 16 to 24 min., depending upon the service demand. The water from the mixing chamber is delivered at or near the surface level in the second compartment, where a subsequent quick sedimentation is produced, due to complete distribution. Complete clarification takes place before the covered storage is reached. The chlorination treatment is provided for both before and after sedimentation and coagulation.

In the construction of the aërator, after the cone was cast and the angle irons were embedded in the concrete, the upper legs of the short angles were wrapped with wire and the entire surface was coated with a thin grout, to prevent oxidation and deterioration.

The cost of forms in the construction of the exterior reservoir wall was considerably reduced, and the placing of steel was facilitated, by the use of a series of concrete blocks that were cast in place radially and to an exact circle.

These blocks were entirely enveloped in the poured concrete and permitted the deposition of the concrete of the wall and footing section, which extended 2 ft. 4 in. outside and 6 ft. inside of the interior surface, at the same operation. Six per cent. of hydrated lime was



THIN CONCRETE FOOTING SLABS HOLD SUPPORT BARS AND FORMS

added to the cement to increase plasticity in the depositing of the concrete for the outer wall. The usual tower method was used in placing the concrete, the mixture being chuted from the main tower to a central auxiliary tower from which continuous placing took place.

The entire work, including the pumping station at the lake and the transmission pipe line, was designed and constructed under the supervision of Charles H. Hurd, consulting engineer. R. J. Buck, of Mr. Hurd's staff, acted as resident engineer. D. E. Helfrich is superintendent of the plant.

Function of Corporate Contract Bonds—How Obtained

Great Care Must Be Exercised by Surety Companies in Issuing Them — Questions Asked by Bonding Companies — Many Rejections

By Harmon V. Swart
Specialist in Contract Bonds, New York City

A CONTRACT bond is a guarantee of the financial standing, moral integrity and practical ability of a contractor to perform the work which he contracts to do. It should, therefore, be seen easily that the many questions which the surety companies ask the contractor as to his standing are not idle. It is not a fact, as often stated, that any contractor can get bonds by paying the premium, but yearly large numbers are refused, and it is a mark of distinction to be able to procure one. With these facts in mind, an enumeration of the questions asked and the reasons therefor may aid in a better understanding of the time necessary to verify the contractor's answers, may induce him to make early application for his bond and so arrange his affairs that there will be no delays due to uncertainties as to his standing.

Years ago, during the early development of the contracting business, and before the days of such sizable contracts as a New York subway, a 2200-room hotel, a tunnel sewer running several miles, a cantonment, an industrial city, or a railroad tube under a great river, the contractor doing the work was not required to give a bond. The man who was having the work done knew the contractor personally, knew him to be honest and able to complete the work, and that was security enough. Later on, some sort of security was deemed necessary, and a personal bond was given by the contractor to guarantee that he would complete the work in the specified time and would do it according to the stipulations set forth in the specifications.

After experience proved that changes in the financial status of the contractor not infrequently made it difficult, if not impossible, to collect damages in the event of nonfulfillment of the contract, more dependable security for performance was found desirable. This brought into being companies organized under the banking and insurance laws, designed to furnish bonds for contractors to be given as a security or guarantee that their contracts would be performed in strict accordance with all agreements and stipulations. These bonds are called "corporate surety bonds"; they are commonly known as "corporate contract bonds."

Surety Company Assumes Real Responsibility

The companies themselves are known as bonding or surety companies and are required by the banking or insurance laws to carry and maintain unimpaired their capital and surplus, as well as a liquid reserve fund sufficient to pay any losses impending by reason of defaults of the contractors bonded. By issuing a contract bond, the surety company assumes a genuine responsibility, which makes it necessary for the surety to satisfy itself that the contractor is thoroughly reliable and abundantly able to execute the contract.

Because they overlook this necessity, many contractors, in obtaining their first bond, are inclined to feel that the surety company is entirely too inquisitive and too much inclined to ask questions intended to elicit information which, they feel, does not concern it and can have little or no bearing on the subject. The request for the information is neither idle nor foolishly inquisitive. Naturally, the underwriters, like all other busy men, care nothing about the financial standing and personal relations of any contractor, except in so far as this information is needed by them in judging whether or not he is a good or a hazardous risk. A dependable contractor, who has nothing in his record he needs to conceal, is perfectly willing to have his reputation and bank accounts thoroughly searched. Having been accepted after the rigid investigation that surety companies very properly make, he may well be proud that he is able to obtain contract bonds.

What the Surety Wants and Why

Surety companies ask from a contractor doing business as an individual sufficient pertinent information along certain lines to enable them to underwrite him; that is, to determine whether he is a proper man for whom they may, with reasonable safety, pledge their credit in the form of a bond to those with whom the contractor makes agreements. They ask the contractor how he has conducted his business in the past, in order to determine whether or not he takes advantage of every technicality in a contract and just keeps within its bounds and no more; or whether he is thoroughly conscientious and eager to do not only all the contract calls for, but possibly a little bit more, if necessary. They ask whether he has paid for material on note or invoice bases and whether he met payments promptly, because they want to know whether he is making wise use of his capital and borrowing capacity, or whether he is overreaching. The answer to this question has an obvious bearing on the question whether bonds should be issued for him. Financial embarrassment would be one of the first and surest causes of default on the part of the contractor.

The surety asks which type of subcontractors he employs, and the regard in which they hold him as a general contractor, in order to determine whether there is any likelihood of trouble arising between him and his subcontractors. It wants to know how he is regarded by architects, engineers and owners for whom he has done work, because such opinions afford valuable guidance, from an outside viewpoint, to his capacity and methods, both technical and business, and also to whether he is a man of his word, worthy of confidence and agreeable to deal with, or contentious, fault-finding and possessed of ability to deliver excuses rather than finished work. Similarly, the contractor's general reputation for honesty, integrity, reliability and dependability is inquired into. Why not? When you are asked to put your credit behind a man's promise to do something, it is natural to want to know something about the man who makes the promise.

Because the surety may become liable for the contractor's debts in case he defaults, it inquires as to his relations with banks on previous contracts; how his obligations were met; the line of credit that was extended by the bank and its inclinations as to future credit; as to his financial responsibility; cash in bank; whether he owns stocks and bonds and in which companies—whether old and established or new and unproved companies; as to any mortgages, and the property, and whether they are first or second mortgages. May the surety not also ask the contractor whether he

owns any real estate, and whether it is farm or city property, improved or not improved, income-producing or otherwise, free and clear of incumbrances and in his own name or in his wife's name? In some states the law prevents a wife from jeopardizing her property on behalf of her husband, so that property held in her name cannot well be considered an asset of the contractor.

Questions Regarding Equipment

After satisfying itself as to the character and financial responsibility of the contractor, the surety must also consider whether he is properly equipped to do the work and in a position to prosecute and expedite it. Hence, it asks full information as to plant and equipment and why it is suitable for the contract in question; the quantity of material on hand which is suitable for the contract in question; other contracts he has under way and their condition as regards completion; amounts of payments due and payable on work already under way, together with approximate due dates on future payments; whether any of these payments are assigned or tied up in any way by litigation, liens or differences of opinion. It needs particulars of each item.

For like reasons, it asks the amount of his loans from banks and other sources; the amount of accounts payable for materials and due to subcontractors for work under way or completed; a complete list of all other obligations, such as indorsements of notes, surety for others, etc.; whether the contractor has ever taken advantage of the bankruptcy laws; and, if so, it asks detailed information of the settlement with his creditors.

Is it not entirely natural and businesslike for one who is asked to assume financial responsibility for your debts to be interested in inquiries of this nature?

If the contractor is a corporation or a firm, the same lines of inquiry are pursued, also the assurance is required that each individual member of the corporation will back his company to the limit of his personal responsibility.

From this information a statement of assets and liabilities is made up, and, by a careful weighing of the value of the assets, a conservative net worth is shown. The balance of assets over liabilities must be real and based on sound assets in which slow assets and doubtful ones—such as equities in properties largely encumbered—are either disregarded or largely discounted. Apparent worth based on bookkeeping trial balances, until so analyzed and verified, carry little weight. The actual net worth is derived from real, available assets. Paper assets or slow assets that may have a financial value some day, if everything goes right and nothing untoward happens, receive little or no consideration.

Satisfied as to the contractor's financial responsibility, the board of underwriters then determines whether the contract on which a bond is sought is similar to the previous work handled by the contractor, or whether it is a line of work entirely or for the greater part new to him. Quite naturally, the surety company will issue a more substantial bond to a contractor doing familiar work, on which he has proved his ability, than on unfamiliar work where there is room to doubt his ability to handle it successfully.

For many years, contract bonds have been required on all municipal, county, state and Federal Government work, and it is fast becoming the custom to require the contractor to furnish a surety bond on private work of large volume. The latter condition seems to have created a misunderstanding on the part of some contractors, resulting in a mistaken belief that contract bonds are a necessary evil and are required only of contractors who are not financially and otherwise thoroughly reliable. As a matter of fact, a contract bond is a clean bill of health as to a contractor's financial and technical ability, his character, standing and record—a passport into the society of the elect. To be able to furnish such a bond is something of which the contractor has every reason to be extremely proud.

Moreover, the contractor who hesitates when asked to furnish a contract bond places himself immediately, and probably without realizing it, in the same category with the man who accepts as an insult any inquiry into his credit responsibility and refuses to buy, indulging the while the impulse of self-pity by fatuously declaring he will place his orders where his credit is good. Business and financial responsibility never shrinks from careful scrutiny, for the result of investigation is always additional good-will, an asset of the highest value. The contractor who fails to realize this is unwittingly doing himself a grave injustice; which, if inflicted by another, would be resented with no little zeal. A contract bond shows to the world that the acid test proves the contractor to be absolutely honest in action and intent as a man, thoroughly reliable and dependable as a contractor, and that he has the money to back up his reputation.

Contract Binds Owner Also

The contract bond also binds the owner, who is described in it as the obligee, to make payments at stated intervals in accordance with the terms of the contract, or run the risk of forfeiting the protection of the bond. The owner is ready and willing to carry out fully all his agreements, because the mere fact that the contractor is able to give bond is assurance that he has been looked up thoroughly, and his capability and responsibility have been verified from every possible angle—in short, he has been weighed in scales of minute accuracy and sensitiveness and found to be a plus unit, 100% pure.

There is still another point that should be cleared up in the minds of some contractors. No small number of them are not only under the impression that any contractor can get a bond by merely walking up and depositing the premium on the counter, but they fail utterly to take into consideration the element of time necessary to complete the transaction. I believe I have made it quite clear that every contractor cannot get a contract bond, but the realization that the matter cannot be unduly hurried is of equal importance.

From the kind of investigation made by surety companies and the reasons for it, given earlier in this article, it requires no great stretch of fancy to realize the importance that is placed on the answers made to inquiries; and, from the nature of the questions, it is equally easy to realize that a sufficient amount of time must be allowed to verify the information given. Here again the contractor suffers a self-inflicted injustice by not making application for the bond early enough, and thus lays himself open to the embarrass-

ment of having his application rejected. If contractors could be made to realize the large percentage of applications, from concerns of supposed good standing, that are rejected, they would allow more time for proper investigation, and fewer disappointments would result.

The best possible advice that can be given to the individual contractor is to "get his house in order," for in this period of reconstruction there will be an abundance of work for the man who is ready and able to take it.

The Engineer in Politics—By One Active Therein

W. A. Stinchcomb, Recent Candidate for Mayor of Cleveland, Explains Why Engineers Are Fitted for Solving Political Problems

ENGINEERS themselves are largely to blame for their present position and relatively inadequate compensation, according to W. A. Stinchcomb, county engineer of Cuyahoga County, Ohio, and recent candidate for mayor of Cleveland. In an address prepared for the recent meeting of the American Association of Engineers, reproduced below practically in full, he strongly advocates participation in politics both by the association as a body and by individual engineers. Even the problems of financing and taxation should be attacked by engineers, he asserts, because of their experience in the execution and organization of work on the basis of lowest unit costs, and engineers are urged to take a dominant part in civic life, not only as a right, but as a duty they owe to society. Mr. Stinchcomb said:

To say that the American Association of Engineers and its members shall not go into politics would be to deny to the country and the local communities within which the association has chapters the service of an organization of men who, by natural ability, by education, by training and by experience are most capable of serving the public and in directing and educating the voters on questions of public policy, and would deny to its members the fulfillment of their obligations as citizens of this republic.

Now, I know that a natural tendency exists among engineers not to take an active part in politics, but by this they evade their full responsibilities as citizens. Shall anyone say that the engineer's training and experience do not better fit him to solve the problems of government, as our civilization becomes more complex, than one trained in any of the other great professions?

Nature of Political Problems

In our cities practically all of our public problems are subject to scientific analysis. Is the subject one of developing the physical plan of the city, including the adequacy and location of its highways, the kind and strength of its pavements, the development of its parks and recreation facilities, the working out of proper drainage or the planning of its transportation facilities, either rail or water? Surely, the engineer is best qualified to solve such problems. He is now called on for advice in these matters, and in my opinion he should be the one to decide.

In matters of public health, as influenced by problems of sanitation such as sewage and garbage disposal, water-supply and building and housing regulations, he is best qualified. On questions affecting the control of public utilities such as transportation, electric or gas supply and telephone service, his engineering training best fits him to bargain with the trained mind representing the public-utility companies, and to know when the contract has been made that justice is done both public and service corporation.

As cities extend further into the realm of municipal ownership of these public utilities, the engineer's obligations to serve the public in an executive capacity increase.

Even in the welfare and social problems of the city his analytical training fits him to search out the cause of our social evils and ills, to relieve them rather than apply only palliative and preventive measures. Shall anyone say that he is less qualified to organize and direct the ordinary housekeeping affairs of a city because of his training and experience?

One of the most difficult and always present problems of all government is that of financing and taxation. It is the constant duty of the engineer in his practice so to design, execute and organize his work that in terms of unity cost that cost shall be as low as possible. All problems of public taxation must go back to a proper appraisal of the property taxed, whether that property be in a tangible or intangible form. Here again his experience and training fit him well to serve efficiently.

Our national government problems are best solved when the engineering mind influences their solution.

And so, in my opinion, the engineer should take a dominant part in politics, and this association as an organization should wield a forcible influence in determining the civic and governmental policies—not as a right only, but as an obligation which both the engineer and the association owe to society.

Political Activity Beneficial to the Association

"But," I hear some timid soul say, "what effect will that action have on the engineer and this assocation?" In my opinion, it cannot be anything but beneficial.

This convention has had its attention called to the inadequacy of the salaries paid engineers in public service. Various means will be discussed as to methods by which salaries may be properly and equitably increased. How better can this be done than by the members of this profession taking an active interest in the political questions of their communities?

We have noted the appointment of men fitted by neither education nor training to take charge of departments of public service which really require the services of the trained engineer. We have seen the engineer subordinated to such superiors. He has seemingly been content to let his "light shine under a bushel," and have the accomplishments of his brain and energy appropriated by those to whom they do not rightly belong. By a more active participation of the engineer in politics these injustices would be removed and credit would be bestowed where it rightfully belongs.

We have seen national organizations of other professions jealously guarding the business interests of the members of their professions. There is the national bar association and the various national organizations of the medical fraternity, whose efforts are used not only in maintaining a proper code of ethics in the profession, but in seeing that the members of that profession as a body are not discriminated against by the passage or operation of what they consider unjust laws. And so, in halls of legislatures their representatives are seen when measures affecting those professions are under discussion—and the professions referred to do not have to do with the public work of the state in any degree compared with the engineer.

It has always seemed to me that the engineer himself has been to blame for the position in which he is held by society and for the meagerness of the salaries paid by both public and private corporations for his services. He has been retiring in his nature, content in too large a degree to take his reward from the satisfaction growing out of difficult problems well solved and difficult work well performed.

We cannot in a democracy expect to maintain our Government for any length of time in advance of the intelligence of the voters. The intelligence of the voter is only expressed through the polls and is influenced by the kind of political education which the voter received. In elevating the standard of citizenship the engineer can and should be a leader in his community. To be anything less not only results generally to the disadvantage of the individual, but decidedly to the disadvantage of his profession, and is a direct evasion of the responsibilities of citizenship which his training and ability impose upon him.

ENGINEERING LITERATURE

A REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Railway Development

EFFICIENT RAILWAY OPERATION—By Henry S. Haines, M. Am. Soc. C. E., M. Am. Soc. M. E., Formerly Vice-President and General Manager of the Plant System of Railroad and Steamship Lines; Also Commissioner of the Southern States Freight Association; Ex-President of the American Railway Association. New York: The Macmillan Co. Cloth; 6 x 9 in.; pp. 709; illustrated. $4.

"Railway development" would seem a more appropriate title for this interesting book, since it deals only incidentally with railway operation—as this term is usually understood—but consists mainly of a summarized review of history and development and future prospects in the entire field of railway construction, equipment, organization and service.

Bridges, foundations, concrete, tunnels (ancient and modern), rails, track, signals, coal and water supply, freight yards, and passenger and freight stations, are covered in 100 pages. Locomotives, cars, brakes, couplers, car lighting and heating and various allied subjects occupy 100 pages. Traffic and transportation (100 pages) include accidents, train speed, train equipment, ticket and baggage methods, car interchange, tonnage rating, train resistance, dispatching and block system. Operation (34 pages) covers organization, personnel, engineering department and training for railway service.

Obviously, with such a wide and varied list of subjects in a limited space, the treatment touches mainly the high points and is necessarily incomplete in many respects. Some inaccuracies occur. For instance, the Belpaire boiler is attributed to France instead of to Belgium and is said to have radial stays, whereas its crown and top sheets are flat and the radial-stay boiler is an American type. Comparison of railway and water transportation is hardly illumined by the statement that a freight train "can" make the round trip from Buffalo to New York in five days while a barge "requires" six weeks. Probably the train does not make such trips, while the barge time includes waiting for a return cargo. Certainly, even a barge "can" make the trip in less than six weeks.

Special mention may be made of the 50-page chapter on military transportation, an unusual subject of direct interest at this time. It begins with the achievements of Xerxes the Persian, but gives considerable attention to the Civil War, modern foreign wars and the great war of 1914-1918. The material is somewhat disappointing in that it deals largely with specific events and operations and, although it gives a mass of miscellaneous information, it has comparatively little about principles, methods or systems of organization. In fact, this chapter, like many of the others, is suggestive or informative rather than instructive, although it is highly interesting.

One fundamental principle that is brought out is that while there should be close correlation between the military and the railway organizations, the latter should be in direct control of the transportation service between the points designated by the former. Where military officers are permitted to control train movements there is sure to be confusion and congestion. This has been proved in many instances, including our own very recent experiences. A more technical work on this subject would be of value to both military and railway authorities.

Electric traction appears to find little favor with the author, and he sees little prospect of extensive development for either main lines or interurban lines. Rather pessimistically, he seems to view the jitney motor car as a possible serious competitor of suburban lines, but a considerable part of his chapter on motive power deals with electric locomotives and service. Appendixes covering 165 pages include a variety of statistics, together with rail specifications, and lists of tunnels, yards and large terminals; also regulations for military railway organization. A bibliography, an index and lists of railways and persons mentioned cover 50 pages.

The above notice of this book is intended as explanatory of its scope and character rather than as a critical review. It is a pleasure to add that the book is written in an attractive and interesting manner, and that it includes a wealth of information that can hardly be indicated within the space here available. With the exception of some diagrams and rail sections there are no illustrations, but they are not needed and would add little to the value of the book.

Walker's Building Estimator's Book

THE BUILDING ESTIMATOR'S REFERENCE BOOK—By Frank R. Walker, Author of "Practical Cost Keeping for Contractors." Third Edition. Chicago, Ill.: Frank R. Walker Co. Leather; 5 x 7 in.; not consecutively paged. Illustrated. $10, including 12 monthly supplements.

The earlier editions of this work were reviewed in *Engineering Record* of Jan. 1, 1916, in *Engineering News* of Feb. 17, 1916, and *Engineering News-Record* of Sept. 20, 1917. Changes in the present edition consist of detail revisions to bring practice up to date. Furthermore, the author announces that hereafter there will be issued to purchasers of the book a monthly supplement, which will carry new unit prices as they develop during the reconstruction period. Assuming the user's ability to adjust other costs to his own problem, the book continues to be a valuable aid to the building estimator.

Highway Handbook Much Enlarged

HANDBOOK FOR HIGHWAY ENGINEERS: Containing Information Ordinarily Used in the Design and Construction of Rural Highways—By Wilson G. Harger, C.E., and Edmund A. Bonney, Supervising Engineer, N. Y. State Department of Highways. Third Edition. New York: McGraw-Hill Book Co. London: Hill Publishing Co., Ltd. Limp binding; 4 x 7 in.; pp. 986; illustrated. $4.

The first and second editions of this handbook were reviewed in *Engineering Record* of Sept. 28, 1912, and Sept. 2, 1916, and in *Engineering News* of Jan. 16, 1913, and Oct. 19, 1916, respectively. The present or third edition contains about 350 pages of new material. Chapters have been added on mountain sections for roads; earth, sand-clay and gravel roads; preliminary investigations; and photography, camp equipment, and camp

medicines. The subject of specifications has been much enlarged. In fact, additions have been made to practically all the chapters. Although the author still draws numerous examples and standards from practice in the New York State Highway Department, the criticism that the original book was too local in character has been largely removed by the addition of material taken from reliable sources of information from Maine to California and Alaska. An evident effort has been made to bring the book up to date and to cover all phases of design and construction.

Vital Statistics Made Easy

VITAL STATISTICS: An Introduction to the Science of Demography—By George Chandler Whipple, Professor of Sanitary Engineering in Harvard University Member of the Public Health Council, Massachusetts State Department of Health. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Flexible Cover; 5 x 7 in.; pp. 517; illustrated. $4.

Designed primarily for public health students, this volume promises to be of wide usefulness to health officers and sanitary engineers as well as in the classroom. The theory and practice of vital statistics are clearly and interestingly presented, with many useful observations on statistical presentation and the use of graphical methods in general. Enumeration and registration of population, population forecasts, the calculation of death and other rates used in vital statistics, and the other phases of the subject are taken up. The discussion extends to expectancy tables and the law of probabilities. Apt citations, with historical and statistical data, are given. The use of thin paper, flexible covers and a medium-sized page places the volume among the handiest of the many almost indispensable handbooks of the day.

More Efficient Municipal Government

A NEW MUNICIPAL PROGRAM—Edited by Clinton Rogers Woodruff. New York and London: D. Appleton & Co. Cloth; 5 x 8 in.; pp. 392. $2.25.

EXPERTS IN CITY GOVERNMENT—By Edward A. Fitzpatrick, Ph.D., Director, Society for the Promotion of Training for Public Service. Editor, "The Public Servant." National Municipal League Series. New York and London: D. Appleton & Co. Cloth; 5 x 8 in.; pp. 363; illustrated. $2.25.

The present century has brought marked betterment in municipal government. In hundreds of cities the old, cumbersome system of checks and balances, with its divided responsibility, has given way to a simple form of centralized responsibility in which the value of trained permanent public servants is recognized. In over a hundred cities still more progress has been made through centralization of responsibility in a single executive officer and by a fuller recognition of the value of expert service. The first of the two volumes under consideration, "The New Municipal Program," is devoted to the principles of city government as embodied in the commission-manager plan. The second deals primarily with the need for experts in city administration, how to get them and how to keep them.

Each volume is a work of collaboration. The "Program" is the more concrete of the two, because it embodies and contains supporting arguments for a model city charter of the commission-manager type, something based on the experience of scores of cities during the past few years. The volume on "Experts in City Government" is, perforce, largely academic. It seems rather discursive—if not excursive into fields that are not very closely related.

Chapters in the "Program" that may be specifically mentioned are "Experts in Municipal Government," by A. L. Lowell, president of Harvard University; "Civil Service and Efficiency," by W. D. Foulke; "Franchise Policy," by Delos F. Wilcox, formerly with the New York Public Service Commission and later deputy commissioner of water-supply, New York City; and "City Planning," by M. N. Baker, associate editor of *Engineering News-Record*.

President Lowell, Mr. Foulke and Mr. Wilcox also contribute to the volume on "Experts," and there are also many other contributors, including M. L. Cooke, formerly director of public works of Philadelphia; Charles A. Beard, director of the New York Training School for Public Service, and W. H. Allen, director of the Institute for Public Service. These and other contributors deal with the subject of municipal experts from a variety of viewpoints.

Both volumes deserve the attention of engineers in or in close contact with municipal or other branches of Government service.

Against Government Ownership

GOVERNMENT OWNERSHIP OF PUBLIC UTILITIES IN the United States — By Leon Cammen, M.A., Associate Editor of the *Journal of the American Society of Mechanical Engineers*; Member, New York Academy of Sciences, Etc. New York: McDevitt-Wilson's. Cloth; 6 x 9 in.; pp. 142. $1.50.

Perhaps no gloomier view of what would happen to this country were government ownership of utilities to come has ever been written than is presented in this volume. All other industries, according to the author, would come under government ownership with or following utility ownership. Not merely democratic institutions, but their very spirit would give place to "an autocracy of central government." Our 48 states would become "simple electral [sic] districts." Our great corporations would be forced into politics by government ownership. There would be a reinforcement of "the sinister cohorts of enemy and Bolshevist propaganda." It is some comfort to learn that the author does not mean to imply that advocates of government ownership intend to bring all these evils on the country.

For the most part, the author confines his discussion to railways. He marshals many arguments against their being taken over by the Government. Most of them merit consideration, but some of them seem to be aimed at men of straw. Toward the end the author proposes a regional scheme of private ownership under Federal control. The book seems to be an honest and earnest attempt to save the country from the disaster which the author believes would result from government ownership—a condition that seems more remote than when the book was written a few months ago.

Pollution of Boundary Waters

POLLUTION OF BOUNDARY WATERS REFERENCE: Final Report of the International Joint Commission, Washington-Ottawa. Washington, D. C.: The Commission. Paper; 7 x 10 in.; pp. 56.

POLLUTION OF BOUNDARY WATERS: Report of the Consulting Sanitary Engineer upon Remedial Measures, Mar. 8, 1916. International Joint Commission. Washington, D. C.: The Commission. Paper; 9 x 12 in.; pp. 159; illustrated.

After six years of consideration, the joint commission created to consider the pollution of the boundary waters of Canada and the United States rendered its report last August. The report (summarized in *Engineering News-Record* of Oct. 10, 1918, p. 660), has just appeared in printed form. It is accompanied by a large supplementary report, dated Mar. 8, 1916, by Earle B.

Phelps, consulting sanitary engineer, giving the results of detailed engineering studies and estimates for sewage-treatment plants at communities on the Detroit and St. Clair Rivers, made under Mr. Phelps' direction by H. C. McRae, district engineer, and I. P. Kane, assistant engineer, and like studies for places on the Niagara River by F. C. Tolles, district engineer. The final report is notable for its conclusions that no untreated sewage should be discharged into boundary waters; that the claim of use of these waters for sewage dilution is well founded; and that where city water-supplies are concerned the degree of sewage treatment should be calculated so as not to overload water-treatment plants. A tentative standard is set up, based on recommendations made by the advisory engineers to the commission, George W. Fuller, Mr. Phelps, Prof. George C. Whipple, W. S. Lea, T. J. Lafrenière and F. A. Dallyn.

Canadian Electric Light and Power Plants

ELECTRIC GENERATION AND DISTRIBUTION IN CANADA—By Leo. G. Denis, B.Sc., E.E., Hydro-Electric Engineer, Canadian Commission of Conservation. Ottawa, Can.: The Commission. Paper; 7 x 10 in.; pp. 296; illustrated.

After a brief general summary, the electric supply of each city and town of Canada is described textually, the municipalities being arranged alphabetically by provinces. In addition, there are tabular summaries of power plants, transmission lines, consumption and rates, capacity, ownership, prime movers and generators, load, service, etc., and transmission lines and distribution. The textual descriptions of power plants give much information in small compass. The volume is a credit to all concerned in its preparation. A similar one for the United States would be welcome.

New Monthly Technical Journal Appears

Starting with May, a new technical journal, devoted to highway engineering and contracting, has appeared under the name of *Highway Engineer and Contractor*. It is published monthly (Chicago: International & Trade Press; $2 per year). The initial issue contains articles covering the general highway situation, highway design, highway contracts, selection of materials, maintenance, and cost of roads.

PUBLICATIONS RECEIVED

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be obtained without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or, in case of books or papers privately printed, then to the author or other persons indicated.]

ANALYSIS OF STATICALLY INDETERMINATE STRUCTURES by the Slope Deflection Method—By W. M. Wilson, Assistant Professor of Civil Engineering, F. E. Richart, Instructor in Theoretical and Applied Mechanics, and Camillo Weiss, Instructor in Structural Engineering. University of Illinois, Urbana, Ill.: Engineering Experiment Station. Paper; 6 x 9 in.; pp. 218; illustrated.

LES APPLICATIONS DE LA PHYSIQUE PENDANT LA Guerre—Par H. Vigneron, Paris, France: Masson et Cie, Editeurs. Paper; 5 x 8 in.; pp. 322; illustrated. 7 fr. net.

CLAY-WORKING INDUSTRIES AND BUILDING OPERATIONS in the Larger Cities in 1917 (Mineral Resources of the United States—Part II, pp. 521-582)—By Jefferson Middleton. Washington, D. C.: U. S. Geological Survey. Paper; 6 x 9 in.; pp. 61.

EFFECT OF CURING CONDITION ON THE WEAR AND Strength of Concrete—By Duff A. Abrams, Professor in Charge of Structural Materials Research Laboratory, Lewis Institute, Chicago, Ill.: The Institute. Paper; 6 x 9 in.; pp. 32; illustrated.

THE ENERGY RESOURCES OF THE UNITED STATES: A Field for Reconstruction—By Chester G. Gilbert and Joseph E. Pogue of the Division of Mineral Technology, U. S. National Museum. (The Mineral Industries of the United States.) U. S. National Museum, Smithsonian Institution. Washington, D. C. The Institution. Paper; 6 x 9 in.; pp. 165; illustrated.

THE EVAPORATION AND CONCENTRATION OF WATERS Associated with Petroleum and Natural Gas—By R. Van A. Mills and Roger C. Wells. Washington, D. C.: U. S. Geological Survey. Paper; 6 x 9 in.; pp. 104; illustrated. 20c. from Superintendent of Documents.

FOREIGN COMMERCE AND NAVIGATION OF THE UNITED States, 1918—Washington, D. C.: Bureau of Foreign and Domestic Commerce. Cloth; 9 x 12 in.; pp. 1031. $1.50 from Superintendent of Documents.

ILLINOIS MINING STATUTES ANNOTATED: Including all Illinois Mining Laws—By J. W. Thompson. Washington, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 594. 35c. from Superintendent of Documents.

THE GOLD SITUATION, Oct. 30, 1918—Report of a Joint Committee Appointed from the Bureau of Mines and the United States Geological Survey by the Secretary of the Interior—Washington, D. C.: Bureau of Mines, Department of the Interior. Paper; 6 x 9 in.; illustrated. 15c. from Superintendent of Documents.

INDUSTRIAL HEALTH AND EFFICIENCY: Final Report of the British Health of Munition Workers' Committee—Washington, D. C.: U. S. Department of Labor. Paper; 6 x 9 in.; pp. 374; illustrated. 35c. from Superintendent of Documents.

INTERNATIONAL ASSOCIATION OF INDUSTRIAL ACCIDENT BOARDS AND COMMISSIONS: Proceedings of the Fourth Annual Meeting, Aug. 21-25, 1917. Washington, D. C.: U. S. Department of Labor. Paper; 6 x 9 in.; pp. 306; illustrated. 30c. from Superintendent of Documents.

THE MEASUREMENT OF RAINFALL AND SNOW—By Robert E. Horton, Consulting Engineer, Albany, N. Y. Reprinted from *Journal of the New England Water-Works Association*, Vol. XXXIII, No. 1. Albany, N. Y.: The Author. Paper; 6 x 9 in.; pp. 71; illustrated.

A valuable review of methods of measuring precipitation from the earliest historical records up to the present day, by an engineer who has given the subject long and careful attention.

THE NENANA COAL FIELD, ALASKA—By G. C. Martin, Washington, D. C.: U. S. Geological Survey. Paper; 6 x 9 in.; pp. 54; illustrated.

NEW YORK STATE CONSERVATION COMMISSION: Sixth Annual Report, 1916. Albany, N. Y.: The Commission. Cloth; 6 x 9 in.; pp. 464; illustrated.

NUEVOS METODOS DE CALCULOS DEL HORMIGON ARmado—Por Aurelio Sandoval y Garcia, Professor de la Universidad de la Habana. Segunda Edicion. Habana, Cuba: The Author. Paper; 7 x 10 in.; pp. 11; illustrated.

PROBLEM OF REFUSE COLLECTION IN THE CITY OF ROCHESTER, N. Y.: Report Submitted to the Mayor and to the Commissioner of Public Works. Rochester, N. Y.: Rochester Bureau of Municipal Research, Inc. Paper; 6 x 9 in.; pp. 102, with appendixes; illustrated.

Gives results of a detailed study, with statistical tables, made by Carl C. Cooman, assistant engineer, under the direction of James W. Routh, then chief engineer and now director of the bureau named above.

PROVINCIAL HIGHWAYS BOARD: First Report, Mar. 1 to Dec. 31, 1918. Halifax, N. S.: The Board. Paper; 6 x 9 in.; pp. 195; illustrated.

A complete report of the status of roadbuilding in Nova Scotia from the time of organizing the Provincial Highway Board to date. Describes types of road and bridges used and gives detailed accounts of expenditures.

RESULTS OF MAGNETIC OBSERVATIONS MADE BY THE United States Coast and Geodetic Survey in 1918—By Daniel L. Hazard, Chief of the Division of the Terrestrial Magnetism. Washington, D. C.: U. S. Coast and Geodetic Survey. Paper; 6 x 9 in.; pp. 32. 5c. from Superintendent of Documents.

RULING GRADIENTS AND THE MINOR DETAILS OF ALIGNment: Calculations for Railways Projected in Burma—By C. Richards, Chief Engineer with the Simla Railway Board. Simla, India: The Author. Paper; 8 x 13 in.; pp. 54.

RURAL HOME SANITATION—By V. M. Ehlers and Louva G. Lenert, Sanitary Engineers. Texas State Board of Health. Austin, Texas: The Board. Paper; 6 x 9 in.; pp. 39; illustrated.

SANITARY OPERATIONS IN THE MISSISSIPPI COASTAL District: Final Report by the Mississippi State Board of Health and the United States Public Health Service, 1918-19; With Recommendations for the Permanent Continuation of the Work—By Leslie C. Frank, Associate Sanitary Engineer (Reserve), Director of Sanitation, Mississippi Coastal District. Gulfport, Miss.: The District. Paper; 6 x 9 in.; pp. 31; illustrated.

Besides Mr. Frank, there were four other sanitary engineers, a surveyor, a sanitary inspector, two physicians and a malarial microscopist on this work. The district embraced three counties and a large amount of ditching and oiling was done. Ditching cost figures are given.

THIRD INDUSTRIAL SAFETY CONGRESS OF NEW YORK State: Proceedings Held Under the Auspices of the State Industrial Commission, John Mitchell, Chairman. Albany, N. Y.: The Bureau of Statistics and Information. Paper; 6 x 9 in.; pp. 225.

TREATMENT OF INDUSTRIAL PROBLEMS BY CONSTRUCtive Methods—Washington, D. C.: U. S. Department of Labor. Paper; 6 x 9 in.; pp. 12.

WATER LAWS OF THE STATE OF OREGON: Compiled from Lord's Oregon Laws and Session Laws of 1911-13-15-17-19; Prepared in the Office of the State Water Board, Salem, Oregon, and Published by Authority of the Legislature of Oregon. Salem, Ore.: State Water Board. Paper; 6 x 9 in.; pp. 64.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Value of Engineering in Public Life

Sir—It is evident that your effort to arouse the engineer to his full sense of civic responsibility is whole-hearted. It is equally evident that you have entire confidence in his ability properly to function in public life, and you are to be commended for the endeavor to inspire him with the necessary self-confidence to undertake his important position in relation to his fellow men.

But in your enthusiasm it seems that at times you become somewhat radical. As I read some of your editorials it would seem that the engineer by temperament and training is peculiarly and particularly fitted better to function under most circumstances than the man of any other profession.

Now, I am an engineer. I believe in engineers. And I am in full accord with your sincere efforts to raise the standards of the profession and to arouse in the engineer a full sense of his civic duty and full confidence in his own ability. But I cannot believe he would prove a cure-all for every ailment of our political, economic, or social structure, nor can I believe he would prove most efficient in every position of responsibility or in every circumstance. Engineers, like men of every other profession, have limitations. But I think that I understand your point of view in regard to this and other matters. *Engineering News-Record* is edited by engineers for engineers. It is, therefore, but natural that you should exhibit some professional prejudice, as I choose to term it. Also, it is undoubtedly necessary to be somewhat overenthusiastic upon a particular object in order to have the desired influence upon a class of men who are inclined to be overmodest and ultraconservative. I believe, however, that a tendency might in time prove to develop into a hobby.

ENGINEER.

West Webster, N. Y.

Engineering Training Fits Men for Various Opportunities

Sir—I have just completed reading your issue of May 29, 1919, and on p. 1075 note two interesting references to an article in a recent number written by a young man expressing his doubts of a future in the engineering field being sufficiently remunerative to warrant his preliminary effort and expense in fitting himself with a technical education.

May I voice a thought which comes from my personal experience and which seems to be universal among men with whom I have talked on the subject; namely, that a technical education as a foundation fits a man to any job of ordinary proportions and demands, makes him flexible to meet and qualify in the countless opportunities that come preliminary and preparatory to the great big opportunity that becomes that man's lifework.

Since graduating from college in 1909 I have suffered and enjoyed a varied experience, which in the main has been a commercializing of my technical training. I found in the early days of this experience that if I followed the field career my results would be mediocre and my end untimely, and with a view to the future looked about for some means of capitalizing my engineering education. I became a sales-engineer and trust that my present employers consider me such today. At any rate I am supervising a district sales organization whose effort is directed along the lines of sales-engineering service to the field—or, better still, engineering-sales service, for the advisory engineering service comes first in all cases. The men in this organization are, with a few exceptions, technically and practically trained engineers, and I am frank to say receive a monthly stipend considerably in excess of the $160 obtained by Lucien Alter as a laborer. These men are all in the early and middle thirties, with families of varying dimensions, and I know of two that receive flattering dividend checks from investments made on past surplus bank accounts.

There are vast opportunities for the technically trained man, and I sincerely hope that Mr. Alter will read this article and if any further inspiration is needed will be glad to give him some personal history by correspondence.

WILLIAM S. MILLER,
District Manager, the Lakewood Engineering Company, Cleveland Branch Office.

Cleveland, Ohio.

Salary Schedule Proposed for Railway Engineers and Draftsmen

Sir—In view of the considerable discussion concerning economic and social phases of the life of engineers and draftsmen and the attempts to better the situation generally, it may be of interest to state that representatives of the International Federation of Engineers' and Draftsmen's Unions received a hearing at Washington by the Board of Railroad Wages and Working Conditions of the United States Railroad Administration, May 12-13. In behalf of engineering and architectural employees in all branches of railroad service, both in field and office, a brief was presented to the board, and testimony was given concerning its subject matter. This brief embodied four principal suggestions considered to be of prime importance, and requested their adoption by the board in recommendations to the Director General of Railroads.

One of these was the request that in case the widely rumored reduction of forces should occur (it *has* already begun) a system of pro-rata furloughs should be instituted, to affect all employees who are classed as permanent; making it possible for many men to tide over emergency periods and for some to use their off time to find permanent locations elsewhere. These latter would naturally be taken from the rolls and thus automatically reduce the pro-rata lay-off for the remainder. When this method was suggested in our organization for the shipyard draftsmen, it was approved by them almost without exception as being preferable either to flat discharge or practically enforced acceptance of lower ratings.

A further request was for the establishment of regulatory committees, to be composed of the more responsible technical supervisors and representatives of the managing officials. Such committees, by applying the schedule and budget principle to work which is to cover

somewhat lengthy periods, could greatly reduce the tendency of railroad work to go by fits and starts, and be of great value in breaking the disrupting force of periods of financial depression. The fact that projected railroad construction and the men at work on it usually feel the first effects in times of stringency hardly needs repeating, but the fact of continual danger in breaking up field and office organizations and throwing the men into the market, to compete against and undercut those left at work anywhere in the country, warrants frequent repetition.

Any abrupt and continued cessation of plan-making by engineers and architects is bound to have results reaching far out into labor and business fields.

The third point of the brief was the creation of office committees, similar to those in many industries, which will put into operation the classification of technical employees and the standardization of their positions, so far as these objects may be accomplished. It was suggested that machinery be adopted for this purpose similar to that instituted by the Macy board in the private and Government shipyards. In this way matters of classification and the adjustment of differences are taken up with supervisors and department heads or managing officials, and in rare cases, of special difficulty, with a regional examiner appointed by the board.

And, finally, there was presented the following salary schedule which we feel is very moderate and which is a minimum scale of monthly pay:

Chief draftsman	$300.00
Leading draftsman or squad-man	250.00
Draftsman, Class A	210.00
Draftsman, Class B	175.00
Draftsman, Class C	135.00
Tracer, Class A	125.00
Tracer, Class B	75.00
Assistant engineer (or engineer-inspector)	250.00
Assistant inspector, Class A	200.00
Assistant inspector, Class B	150.00
Instrumentman	210.00
Rodman, Class A	175.00
Rodman, Class B	150.00
Tapeman, Class A	125.00
Tapeman, Class B	100.00

Regular hours to be 7½ hours on five days of the week and four hours on Saturday, making 41½ hours per week; no overtime except where absolutely necessary, and at the option of the employees, and time and one-half for all overtime ordered or made necessary. All traveling and other expenses incurred for railroad business, and also expenses attached to moving headquarters, should be allowed. Civil service rules should apply regarding vacation, holiday and sick leaves. No salaries now in existence are to be reduced. This schedule is slightly lower than that of the Macy board award to marine draftsmen, and it is certainly small when compared with the more than 100% increase in living costs in the past five years.

The publication of the full record of this hearing, and also of a previous hearing of representatives of the American Association of Engineers, is contemplated by the International Federation of Engineers' and Draftsmen's Unions. It may be news to many of your readers that 28 locals were represented in the convention of our international in New York on Apr. 1. The president and secretary, respectively, of this federation are A. J. Oliver and A. H. Miller; the address of the latter is American Federation of Labor Building, Washington, D. C.

T. S. FORD,
Chairman, Publicity Committee, Draftsmen's and Designers' Union, Local 14.
Chicago.

Are Services Paid What They Are Worth?

Sir—I was surprised and just a little shocked to note the attitude expressed in the letter written by the president of the Rensselaer Polytechnic Institute, as printed in your issue of May 29, 1919, p. 1075. I certainly wish to take issue with his statement that "services, in the long run, receive the payment that they are worth." An advertisement in the *Literary Digest*, in its appeal for increased salaries for school teachers, but which holds good for engineers as well, contains the following:

The men and women who are making the Americans of tomorrow are being treated with less consideration than the janitors who sweep out the buildings in which they are employed; they are earning on the average less than the wages given to scrubwomen employed in the public buildings of the United States Government. Normal-school graduates receive less salary than street sweepers; high-school principals and superintendents less than section foremen; country school teachers less for instructing the farmers' children than he pays his hired man to feed the hogs.

In a certain town of Illinois, for instance, the average wage of 15 miners for one month was $217, while the average monthly salary of 15 teachers in the same town was $55. In another town a miner—who, by the way, was an enemy alien—drew more than $2700 last year, while the salary of the high school principal in the same town was $765. We welcome with all our hearts the long-belated recognition that is being given to the man who works with his hands. We believe that this same workingman will be the first to join with us in asking better pay for those who teach his children.

Unless the teachers of this country are not worth a living wage it would appear that Palmer C. Ricketts is clearly mistaken when he states that "services, in the long run, receive the payment that they are worth." That remark belongs to the class of commonly accepted generalities usually found, upon analysis, to have so many exceptions as to bear little relation to the facts. The basic idea that services should be paid what they are worth is far from being universally accepted as a general principle.

Bear in mind that $1500 per year provides bare subsistence at present-day prices for an average family of five, and that $2100 is required to maintain "security and citizenship level," according to a recent Federal wage inquiry. What does the average salary of thousands of ordinary engineers look like? Not members of the American Society, or presidents, managers, and chief engineers of corporations, but just average engineers?

Consider these instances: Railroad engineer, 13 years' experience, in charge of construction, $135 per month; four assistant engineers have salaries ranging from $96 to $124 per month, and from 3 to 17 years' experience. *On the same job*: Steam-shovel engineers, $200 per month; contractors' chief clerk, $150; team foreman, $150; fireman, $125.

On another job an assistant engineer, a graduate of exceptional ability, supervising the activities of several squads of survey parties, received $35 per week. One of his rodmen, 18 years of age, earning $20 per week, was given the job of carpenter foreman at $65 per week, *although totally inexperienced!* The chief engineer on this several million dollar construction job received $75 per week.

If engineers are being paid all that they are worth, and this amounts, as it does in so many instances, to less than is required to live decently, there should be only one of two courses open: Either teach engineers to earn more, or else get along without them.

I believe that most men who are in engineering are in the game because they love it. They have no longings for "royal salaries," and are really willing to devote their lives to service to humanity, but, first of all, they have to live to do it. How can engineers make progress when they cannot afford to buy the books and magazines which are necessary? What sort of work can we expect from the engineer with righteous discontent in his heart because he knows his family is suffering hardships while others producing much less receive a great deal more? Certainly, the engineer deserves a little more than the average mechanic or common laborer, if only because of the extra expenses due to societies and studies that will enable him to learn better methods and thus render higher and better service beneficial to all mankind.

Until our intellectual leaders become sufficiently progressive to advocate methods making for social justice, and a fair opportunity for everyone, there will always be a fertile ground in which Bolshevism or some similar symptom of economic protest may develop. America is far from being free from the taint of it.

The only positive remedy is *more production, more equitable distribution,* and the *elimination of unemployment.* The time and motion study of the industrial engineer, the social economist, the welfare worker, big business, labor, all thinking men, can, through intelligent coöperation, achieve in the short period of ten years any reasonable economic ideals. The misfortune is that our intellectual leaders dismiss such thoughts as these with the epithet of "paternalism," and our radicals cry that they are opposed to the spirit of democracy, or anarchy, or socialism, or unionism, or whatever cause they may happen to espouse, while misery, disease, and poverty remain at liberty to choose their victims.

E. N. GOLDSTINE,
Junior Member, Am. Soc. C. E.

Terre Haute, Ind.

Sir—In your issue of May 29, 1919, p. 1075, you print two letters commenting on a letter to you signed by one Lucien Alter. I feel somewhat presumptuous in taking issue with either the president of Rensselaer Polytechnic Institute or a man like Mr. Stierlin with his long years of experience. I shall have at them both, however, for I believe that both, while they sense in a vague way the undercurrent of unrest which is disturbing our profession, have either missed entirely or deliberately ignored the conditions which are causing it.

First, Mr. Ricketts: I feel sure that when one takes into consideration the dollars actually spent and the dollars a man could have earned if employed productively during the time he was busy at college, one would not be far from the truth in setting the expense of a college education at $1500 a year.

The engineering education does not pay in money. It is an intangible something that seems to be part and parcel of the profession, a hope for the future and a certain measure of the idealism and professional pride which keep us in engineering work. This is particularly true of the young man—not the graduate of a year or two, but the man from five to ten years out of school.

What is a fair wage for such a man? Certainly, he has a right to expect to be able to support his wife and children decently. There are those who dare as far as a wife, but I maintain that the thought of possible children is a nightmare to most young engineers of my acquaintance.

Now, Mr. Stierlin: This gentleman writes of the very things I mentioned above. The idealism keeps us at our work, but it is the despised dollar that pays the butcher and baker—the fellow citizen for whom we are to create useful things. We aim not at an estate to leave behind us, but at a chance to live a full life cleanly and honestly, to pay our bills and look every man in the eye.

I feel certain that these gentlemen have written hastily. Do they know that local engineering clubs and societies the country over are affiliating with the American Federation of Labor? If they know that, do they realize what that means to our future professional life? Has either of them really endeavored to get first-hand information of social and economic conditions in the profession outside of the little section that comes under his personal observation?

I would commend to them the American Association of Engineers, which is spending time and money to seek out and cure the ills we suffer from as a profession. Knowledge of them may be had for the asking. The discontent is widespread and not at all confined to surveyors and draftsmen; even if it were, they are our engineers of tomorrow.

Let us not disagree among ourselves; that way lie confusion and defeat. Let us rather find the right solution by careful investigation, and then work together to bring about the better days. ERNEST R. TAYLOR.

Cleveland, Ohio.

Sir—It is evident from a letter appearing in your issue of May 29, 1919, p. 1075, that Palmer C. Ricketts, president of Rensselaer Polytechnic Institute, is greatly concerned over the effects that discussions relative to the compensation received by engineers, lately appearing in your journal, might have upon prospective students of the profession. This letter refers to a previous one published in your issue of May 8, 1919, p. 931, which is worthy of closer reading than that apparently given it by President Ricketts. In this connection, I desire to point out that young Alter did not state that he intended to spend $1500 a year to obtain an engineering training, but spoke about an investment of $1500 per annum, an entirely different matter.

I happened to be in Dayton last summer and came in frequent contact with young Alter, and it was I who gave him the estimate of the investment necessary to obtain an engineering education. After consultation of the catalogs of a great number of engineering schools, it was found that the average cost of one year's training would amount to about $1000. To this was added $500, the savings of a section hand for a period of ten months, at $4 per day, thus making a total investment of $1500 per annum. This figure ($1000) agrees very closely with an estimate given by a member of the American Society of Civil Engineers in *Engineering News-Record* of Jan. 23, 1919, p. 201, and it is quite proper, in figuring the total investment in one year's education, to add to the amount that would actually be spent the amount that could have been saved had the student been engaged in manual labor.

President Ricketts also states that "the complaining letters are most frequently written by surveyors and draftsmen," but I find, in going over the files of *Eng-*

neering News-Record since Jan. 1, 1919, letters pertaining to the compensation received by engineers from the following: A member of the Am. Soc. C. E., a consulting engineer, a dean of an engineering college, a chief city engineer, a European student doing post graduate work in America; an employer of engineers; and a senior civil engineer in the Bureau of Valuation. In fact, only a few letters were written by draftsmen, and those pertained to the dispute with the Navy Department.

It is true that a young engineer is self-supporting from the start and through hard work "need not let the laborer pass him in the running." The remarkable thing is not that the engineer can hold his own and in the end pass the laborer, but that the laborer gives the engineer so good a race. It is almost unbelievable that the compensation paid for following the greatest of all professions is comparable with that received by a section hand.

In his comparison of engineering with the other professions, Professor Ricketts fails to see that while a doctor, dentist or lawyer can look forward to the time when he will have a practice of his own, over 90% of the engineering profession are forever doomed to work for someone else, by the inherent relation of the engineer to industry. That those at the bottom of the profession receive all they are worth is a subject open to much controversy; and that those at the top receive large compensation is not always true, unless they happen to be part owners of large corporations, in which case their large incomes are not the results of professional services rendered, but are the profits of business men. But what about the great bulk of the engineering profession who neither are at the very bottom nor yet have reached the top? What about the great multitude of assistant engineers, chief draftsmen, designers, detailers and checkers?

That a laborer remains a laborer is generally true, but that faithful service and hard work are invariably rewarded by adequate compensation is by no means the rule of the engineering trade. If it were, why should we see such phenomenal growth of an organization such as the American Association of Engineers, composed of men who rank from chief engineer down to the most humble draftsman, or the spectacle of those distinguished engineers and scientists employed by the Bureau of Standards affiliating with the American Federation of Labor, under the leadership of Dr. Edward B. Rosa? From my own experience, I know of assistant engineers employed by the Pennsylvania system, who were only earning $150 per month after 14 years of faithful service, while first assistants on the engineering corps were receiving $85 or perhaps $90 after 10 years. I worked under a chief draftsman of the bridge department of a large transcontinental line who only received $150 per month, and under another who was a graduate of a famous European university, and who after 12 years' bridge-engineering experience in America was getting the miserable pittance of $125 per month! Surely, these men are not mere draftsmen.

Engineering is essentially a question of service, and the engineer is, above all, an idealist. He is not in the profession for what he can get out of the world for himself, but for what he can put into it for others. However, this is no reason why he should be expected to support a wife and raise a family on $175 per month, which I find to be the average pay of the average engineering position. Surely, if the chief engineer of the Bureau of Public Roads can give up a big position to accept a smaller one for $1000 more a year, a prospective engineer has a right to inquire into the monetary remuneration he might receive from his profession, without being classed as a materialist. That engineering does not pay in the monetary sense, at least at the present time, is a fact to be attested by the sad experience of many. I do not wish to entice a youngster into the study of engineering under the pretext that it is a remunerative profession. Let him enter with his eyes open and realize that engineering is a "service that sweats for glory, not for meed." EDMUND FELDMAN.

Jefferson City, Mo.

Sir—Palmer C. Ricketts, in your issue of May 29, 1919, p. 1075, has answered the "invidious remarks" made by a young man concerning the opportunities for making money offered in engineering. He thinks that similar comments which have appeared in *Engineering News-Record* may have a serious effect on young readers who contemplate becoming engineers, and he makes a very positive assertion that an engineering education "pays in money if in no other way."

The trouble is that it usually pays in some *other* way. To illustrate this point we have Mr. Stierlin's letter on the same page with Mr. Ricketts', assuring us that to the real engineer the creation of things useful to mankind is compensation enough in itself, irrespective of worldly prosperity.

Historians or psychologists should make an investigation to discover who it was, or what it is, that is responsible for this suicidal conceit of the engineering profession. Others besides engineers create things useful to mankind, but few donate their services to society, or allow any discount for a laudable satisfaction to themselves from work well done.

Very little experience is required to disclose the fact that subordinate positions in engineering do not entail work so congenial, interesting and agreeable as to compensate for relatively inadequate salaries. It is precisely the pay for subordinate positions, drafting and surveying included, which has given rise to complaint. To what extent the promise of future highly remunerative positions can be considered compensation is a question deserving careful consideration. Some employers deliberately overemphasize this subject of future reward, but this despicable practice is by no means confined to engineering.

At least three factors should be considered before a proper appraisal can be made of Mr. Ricketts' remark that if a man "is able and continues to work very hard he is sure to rise in his profession and be well paid." How little pay can he afford to begin with? How long can he afford to make his apprenticeship? How certain can he be that his industry and ability will finally receive proper recognition?

Mr. Ricketts says, "the cold fact remains, that services in the long run receive the payment they are worth." If this means that all occupations are paid equitably in proportion to the effort involved, or the importance to the community, he is the first to announce that such an ideal state of society has been achieved. Mr. Ricketts does not mean this, and he does not mean that engineers' services (except young graduates') *now* receive the pay-

ment they are worth, or he would probably say so. What he does mean is not at once apparent.

Engineering News-Record has performed no greater service during the past few years than it has rendered by presenting to its readers a free discussion of this question of compensation for the rank and file of engineers. The law of supply and demand may "take care" of the common surveyor's pay and the pay of the ordinary draftsman, but the supply of young men whose ignorance of the situation with regard to engineering salaries is their best excuse for choosing this profession will certainly diminish when true conditions are understood.

It is unfortunate that in his letter Mr. Alter (he of the "invidious remarks") does not more clearly define the issue. He makes it seem that he is discussing the choice of becoming an unskilled laborer or an engineer, and Mr. Ricketts is led to remark that "the laborer generally has to remain a laborer," and has evidently taken it for granted that this is the only question involved. The real issue, for Mr. Alter and for most other young men who would contemplate becoming engineers, is not such a choice as this, which would easily be made. Properly interpreted, Mr. Alter's letter asks this question: If professional engineers after seven or eight years' apprenticeship (including four years in college) are not paid as much as common laborers, would common sense not indicate that it is wiser to choose some other profession, or some other line of business? There are others besides Mr. Alter who are asking this question.

JEROME FEE,
Assistant Engineer, Bay Cities Water Company
Coyote, Calif.

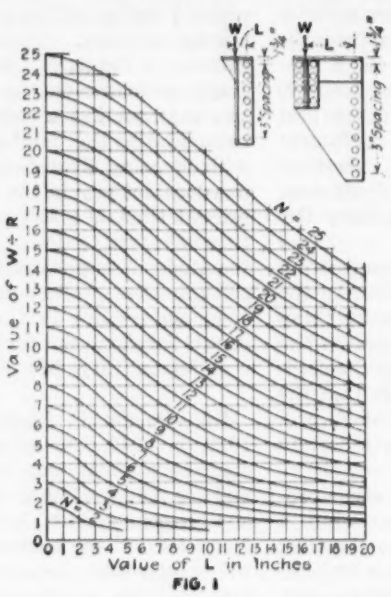
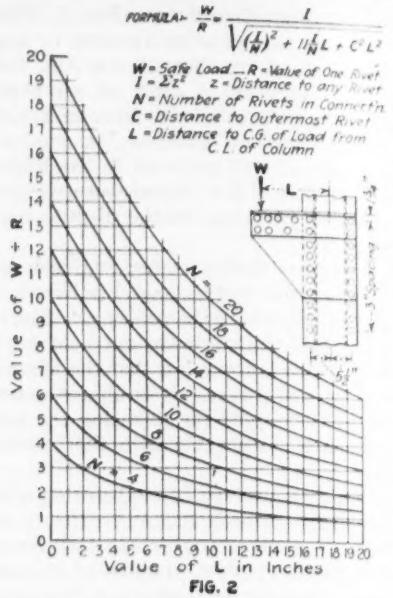


FIG. 1


FORMULA: W/R = I / √((I/N)² + 11²/₁₆ L + C²L²)
W = Safe Load — R = Value of One Rivet
I = Σz² z = Distance to any Rivet
N = Number of Rivets in Connection
C = Distance to Outermost Rivet
L = Distance to C.G. of Load from C.L. of Column
Value of W÷R
Value of L in Inches
N = 20
N = 4
FIG. 2

DIAGRAMS FOR FINDING SAFE ECCENTRIC LOADS ON GUSSETS

Diagrams for Safe Bracket Loads

Sir—The accompanying diagrams for the safe load on gussets or brackets connected with one or two lines of rivets with 3-in. spacing have saved a lot of time and computation in our office. The method of using is probably self-evident. For spacing other than 3-in. the safe load is approximately proportional to the spacing, and for connections with a double line of rivets, where the distance between the center lines is between 10 and 12 in., the safe load is practically the same as for the 11-in. spacing given.

As an example, consider a two-line rivet connection as in Fig. 2, with 14 rivets of ¾-in. diameter. To find the safe load W at a distance L of 8 in. from the center line: Find intersection of curve $N = 14$ with the vertical line 8 and trace horizontally to $W/R = 7$. Then, since the value of one rivet $R = 4400$ lb., the safe load $W = 7 \times 4400 = 30{,}800$ pounds.

Similarly, to find the size of the gusset connection required to carry a load of 25,000 lb. at 12 in. from center of column, using ¾-in. rivets: $R = 6000$, and $W/R = 25{,}000/6000 = 4.17$; then, in Fig. 2, find 4.17 on left-hand scale, follow longitudinally to the vertical line for $L = 12$, and the intersection lies just below the curve $N = 12$. Hence a 12-rivet gusset is required.

The single-line rivet diagram, Fig. 1, is used in precisely the same manner.

Chicago, Ill. F. W. SEIDENSTICKER.

Water Hammer in Penstocks as Affecting Economy of Design

Sir—It seems to the writer that the penstock designer should specify the time of closing, T, before asking for bids on turbines or valves, rather than run the risk of a manufacturer's limit of T causing the use of tons of extra steel in the penstock. The designer can readily do this, since all the quantities except T in the following formula must be known even in a preliminary hydro-electric investigation. The term a, the velocity of vibration along the penstock, may accurately enough be taken at 2600 ft. per second, while h should be taken as a certain percentage of the maximum static head in feet, depending on the good judgment of the designer for its value. We have

$$T = \frac{\frac{LV}{h} + \frac{gL}{a}}{g} \text{ or approximately } T = \frac{L}{g}\left(\frac{V}{h} + 0.012\right)$$

in which

T = Time of closing of gate, in seconds.
L = Length of penstock, in feet.
V = Velocity of water in penstock, in feet per second, corresponding to Q. (Q is discharge in cubic feet per second before gate starts to close.)
h = Head due to water-hammer alone (in excess of static head) in feet.
g = Acceleration of gravity = 32.2 ft. per second.
a = Velocity of vibration along penstock, in feet per second.

The foregoing formula was obtained by solving for T in the equation $h = \frac{LV}{g\,(T - \frac{L}{a})}$ for ordinary water-hammer (T greater than $\frac{2L}{a}$), derived by Minton M. Warren in the "Transactions" of the American Society of Civil Engineers for 1915.

The justification for assuming the velocity of vibration equal to 2600 ft. per second and for thus making $g/a = 0.012$ in the above formula is that the value of T is not appreciably affected by even a few hundred feet or error in the value of a. V/h is readily determined with accuracy and since, in ordinary penstocks, it is several times greater than g/a, there is little use of wasting time in the computation of a value for a, at least during preliminary work.

However, unless a fairly accurate value of T is obtained by using the above formula, any preliminary estimate of the cost of a penstock may be greatly in error since, when T is less than $2L/a$, or when the closing is instantaneous, the stress due to water-hammer may become several times that due to the maximum static head.

It is customary to look into the most important things even in preliminary work, and the writer is inclined to believe that little attention is paid to the value of T until too late in the progress of many hydro-electric investigations.

Elmhurst, L. I. AUSTIN H. REEVES.

[Comments on Mr. Reeves' letter by Robert E. Horton, consulting engineer, and on both letters by Allan V. Garratt, of the Lombard Governor Co., follow.—EDITOR.]

Sir—There seems to me to be much more to the determination of the proper time of gate closing for turbines than appears from Mr. Reeves' letter. Considerations of economy of penstock construction do not wholly govern the time. The suddenness of load changes, the amount of fly-wheel effort in the rotating parts, the use or nonuse of surge tanks or pressure relief valves, and the allowable percentage of speed variation, must be taken into account in fixing the time of gate operation.

Albany, N. Y. ROBERT E. HORTON.

Sir—1. I have read with much interest the letters from Austin H. Reeves and Robert E. Horton.

2. The transposition of Minton M. Warren's formula, as suggested by Mr. Reeves, is interesting. It is in a little different form from that often employed by the present writer, which is

$$T = \frac{L\,V}{h\,g} + \frac{L}{a}; \qquad \text{(a)}$$

or, again, I sometimes write

$$T = V\left(\frac{L}{h\,g}\right) + \frac{L}{a}, \qquad \text{(b)}$$

which is very convenient for slide-rule work where you are chasing permissible values of V.

3. Mr. Reeves states that h "should be taken as a percentage of the maximum head." Has he not, in this, conveyed a different impression from what he intended, which may mislead some? If the static head is 50 ft., and it is intended that the pressure wave head shall be 100% of the static head, it must be used in Mr. Reeves' formula as 50, not 100.

4. Mr. Reeves' thesis, if I understand it aright, is that the designer of a penstock shall arbitrarily assume a value of h "depending upon his good judgment for its value," and then solve for T, and let it go at that, designing the thickness of the walls of the penstock on a convenient value of V and the sum of the static head which obtains and the value of h which he assumes on "his good judgment." It would seem that the above method leaves out of consideration some matters which will loom large when it comes to operating the plant; and the present writer is inclined to lean toward the opinion expressed by Mr. Horton that "the value of T cannot be determined from considerations of economy of penstock construction."

5. Perhaps the present writer's viewpoint may be made more clear by discussing an actual example: Let us assume a penstock 1000 ft. long, 10 ft. in diameter, with the water moving at a maximum velocity of 10 ft. per second, and with a static head of 50 feet.

6. By Mr. Reeves' method we should calculate the time, in seconds, less than which the water column should not be stopped, as follows:

$$T = \frac{\frac{1000 \times 10}{50} + \frac{32.2 \times 1000}{2600}}{32.2} = 6.6 \text{ seconds.} \qquad \text{(c)}$$

7. But, how about this 6.6 sec.? If the penstock is designed on that basis it is evident that the water-wheel gates must not be closed in a shorter interval of time. Now, with the full power that may be developed by this water column—which will be discussed later—it will be impossible to obtain a speed regulation, under commercial conditions, which will be tolerated by the electrical engineers of the plant, unless so large a fly-wheel effect is installed as to be very costly on a horizontal unit, and not only very costly, but also almost impossible to install, on a vertical unit.

8. Moreover, it should be remembered that there is absolutely no way of insuring that T may not be very much less than 6.6 sec. Some turbine gates are of such design that if liberated from control they will slam shut in a surprisingly short time. The critical time of a penstock, or that period of time of arresting the water column at which, or below which, the maximum pressure wave will occur is

$$T = \frac{2\,L}{a}; \text{ in our example, } \frac{2 \times 1000}{2600} = .769 \text{ second,} \qquad \text{(d)}$$

and the maximum pressure wave (for a rigid penstock) is

$$h = \frac{a\,V}{g}, \text{ or in our example, } \frac{2600 \times 10}{32.2} = 0.807 \text{ ft. head.} \qquad \text{(e)}$$

In practice it would be something less than that, depending upon the thickness and elasticity of the penstock walls, but the point I wish to make is that in our example the total head on the penstock, if the water-wheel gates slammed shut in 0.769 sec. or less, would approach 50 ft. static head plus 807 ft. wave-pressure head, a total of approximately 857 feet-head.

9. The supposition in the previous paragraph is by no means chimerical or fantastic. Just such an accident, resulting in the bursting of a wheel case and the flooding of the power house, very recently occurred in the Clinton dam power house of the Metropolitan waterworks in Massachusetts. The attendant lost control of the water-wheel gates in shifting from governor control to hand control. The wheel case was a perfectly good

one, and the ruptured iron was of ample thickness for normal conditions, and showed no flaw. If the wheel case had not let go, the penstock would have done so. It is always possible for the connections between the governor and the gate rigging to break, or for an attendant to lose control of the gates, resulting in a very rapid closure of the water-wheel gates. In the above plant the same operation of shifting from governor control to hand control had been performed safely for years, but at last the unexpected happened.

10. Where the penstock is long, is it not more conservative to provide means whereby the total pressure may be limited to a safe value rather than to rely upon predetermined arbitrary values of T and h which may not obtain under accidental conditions?

11. We should not forget that our penstock is full of water in motion. The water weighs 4,908,000 lb. When moving at a velocity of 10 ft. per second it contains 13,860 hp.-sec. of kinetic energy. This energy is a very real thing. You cannot destroy it. If you stop the water column you have got to expend this energy somewhere. There is only one place where it will be expended, and that is upon the water wheel. Even the small amount of this energy which will be expended in compressing the water and in stretching the penstock walls will very quickly reappear as power in the water wheel.

12. Our water column will develop, through a turbine of 80% efficiency, 3570 hp. If you throw off that amount of load from the turbine you have got to stop the water column as quickly as is feasible, otherwise the turbine will run away. But you are not only throwing off 3570 hp., of load, but at the same time you are supplying the turbine with 13,860 hp.-sec. of energy in addition to its rated capacity under normal head. How about the speed regulation under these conditions? It may be argued that the water column will not be completely arrested. Perhaps so; but that would only minimize the above troubles somewhat. To calculate it here would be beyond the scope of this letter, and would not modify the general argument.

13. Again, if you suddenly throw on a load of 3570 hp., with the water column at rest, the accelerating water has got to develop 13.860 hp.-sec. of energy upon itself before the water wheel can develop full power. If the turbine gates were opened wide instantly, the water column, starting from at rest, would acquire 10 ft. velocity in 6.2 sec., or, if starting from a velocity of 2 ft. per second (which might be velocity at friction load), in 5 sec. We cannot, of course, open the gates instantly. Here we are up against regulation and fly-wheel difficulties again, if the plant is to be subject to large and sudden load changes.

14. It begins to look like a surge-tank and fly-wheel proposition. The commercial load changes which will occur, the speed regulation which will be tolerated, and the permissible investment in surge-tank and fly-wheel effect, must all receive very careful consideration before the time of turbine-gate closure or opening (which may very well be different) can be established.

15. Possibly, therefore, we cannot establish the proper value of T from a simple formula based on V and h which may, perhaps, become of relatively small importance in comparison with more weighty matters.

16. But it must not be argued from the above facts that Mr. Reeves' formula is not valuable. It is valuable, very valuable, but chiefly to calculate quickly what not to do, rather than what to do. If engineers of design would make this formula, in the various forms in which it appears in this discussion, their familiar working tools, the engineers who provide turbines, generators and auxiliary apparatus would not so often be plunged in despair by "specified penstocks."

Ashland, Mass. ALLAN V. GARRATT.

Hard-Surface Road Specifications of the State of Illinois

Sir—In *Engineering News-Record* of May 8, 1919, p. 905, Clifford Older, chief highway engineer, Department of Public Works and Buildings, Illinois, outlines the adoption by the State of Illinois, as a basis for all its rigid surfacings, of a standard concrete slab 7 in. at the side and 8 in. at the center, for 16- to 18-ft. widths, and states that "the only other types considered suitable for the primary road system of Illinois are monolithic brick and bituminous concrete on a concrete base."

Is it possible that the great State of Illinois is retrograding so far from modern designs and constructions as to overlook the absolutely established supremacy of reinforced concrete over plain concrete?

The writer quotes from the article in question:

"It is fundamental that the load-supporting capacity of a rigid pavement is dependent upon its transverse strength, and its transverse strength is measured by its thickness and the modulus of rupture of the material of which the surface in tension is composed."

The modulus of rupture or the transverse fiber strength of *concrete*, which is the material in question, we know is of far less importance than the crushing strength. In fact, it is practically about one-eighth of the latter, and, for this reason, a reinforcement in the bottom of the slab has been introduced to make the modulus of rupture in tension at least equal to the crushing strength; by this means a far thinner and more elastic and resilient body is produced, with great economic results.

According to the conclusions of committee No. 9 of the National Conference on Concrete Roads, 1914, concrete highways are subject to the following six causes of failure or unnecessary deterioration: (1) Changes in temperature; (2) variations in the percentage of moisture in the concrete; (3) defective foundation; (4) improper drainage; (5) insufficient thickness of slab to carry the traffic; (6) faulty construction.

Then follows: "It is necessary, therefore, in a pavement properly designed and constructed, to minimize the cracks resulting from the above causes, by embedding a reinforcement in the concrete, which will so distribute the tensile stresses as to prevent formation of larger cracks."

The same committee further recommends, in general, that all reinforcement should be about 0.1%, which, in the 1916 conference, was further specified.

As an example of the efficiency of such construction, the writer will refer to H. B. Bushnell's article in *Engineering Record* of Mar. 24, 1917, p. 464, as follows: "Twelfth Street, Cook County, Illinois, east of Hillsdale, presents a striking example of the settlement of a rigid pavement laid on a yielding subgrade. At this point the road extends through a slough for 600 ft., and the maximum settlement at the time the last levels

were taken (after 16 months) was 1.74 in. It still is in a very good condition." This concrete was of course reinforced.

The experimental concrete roadways built at Riverbank, Calif., in 1912, have also amply proved the superiority of reinforced-concrete roads after seven years' service. The experience with the concrete roads in Wayne County, Michigan, Owosso, Mich., Iron River, Mich., Davenport, Iowa, Oakland, Calif., and scores of other locations, furthermore, is, as everybody knows, entirely in favor of reinforcement.

While the writer would use a reinforcement of 0.2% per foot width of a slab, we will compare the cost of adding 0.1% of reinforcing fabric to a 6-in. slab with the cost of an additional 2-in. thickness or an 8-in. slab, as follows: $0.1\% \times 6 \times 12 = 0.072$ sq. in. or, say, A. S. & W. Co. No. 068 weighing 35 lb. per 100 feet. At 5c. per pound, laid, this means $9 \times 0.35 \times 5 =$ 15¾c. per square yard of pavement or base laid in position. Two inches of concrete per square yard will cost not less than

$$\frac{2}{12} \times \frac{6.75}{27} \times 9 = 37\tfrac{1}{2}\text{c. per square yard.}$$

And as to the comparison of strength and resiliency between a 6-in. reinforced slab and an 8-in. plain concrete slab, there can be no doubt. Furthermore, the reinforced-concrete base or slab meets, to a large extent, *all* the six causes for failure laid down by the National Conference on Concrete Road Building, while the plain slab meets none.

H. W. Skidmore's article, "Defects in Surface of Bituminous Pavement Due to Concrete Base," in *Engineering News-Record* of May 1, 1919, p. 878, also criticizes the cement-concrete base and suggests "a bituminous-concrete base rather than a rigid one." Why not a thinner, richer, but reinforced-concrete base?

What can possibly induce engineers of the highest standing in highway engineering to ignore all precedents absolutely, as well as one of the most important improvements in building construction?

E. LEE HEIDENREICH,
Kansas City, Mo. Consulting Engineer.

Sir—I have read with much interest the article by Clifford Older, chief highway engineer of Illinois, on "Illinois Adopts a Uniform Basis of Design for All Types of Rigid Pavement," in your issue of May 8. The article is carefully written, and the position of the author gives his opinion great weight. If his premises are accepted as being the fundamental ones to be used in the design of a pavement, his logic cannot be disputed. It would seem, however, that he ignores some phases of the problem which, if fully taken into consideration, might modify the conclusions.

Mr. Older states first, "it is not the primary function of rigid pavements to span soft spots in the sub-grade." He also says, "it is fundamental that the load-supporting capacity of a rigid pavement is dependent upon its transverse strength." The first statement is not open to debate, but the second opens up a field of discussion. A logical formula based on the second assumption is developed, which is used to determine the thickness of the pavement. In other words, the pavement is designed not for its primary function, but for an incidental condition.

The soundness for this conclusion is the one questioned. A pavement is being designed, not a framed structure. Probably Mr. Older and the other able engineers who have concurred in his conclusions had other sound reasons for adopting as a standard the 8-in. ½-, 7-in. concrete slab, but these reasons are not set forth, and it would seem questionable whether the structural theory should be the sole basis for determining the thickness of foundations for all types of rigid pavements.

The thought which occurs after study of the article is that it attempts to cure a defect by covering it up rather than by eradicating the cause. Logically, if later experience shows that the 8-in. concrete is not enough, the thickness must be increased to 9, 10 or 11 in. Just as logically, the redesign of a bridge failure would only require that the members be made heavier. Such a course would excite only derision.

The items entering into the construction of a road are material and labor. The material in the case of a concrete roadway consists of sand, cement, stone and water. The labor consists of grading, ditching and mixing the concrete. The labor of transportation is really a material item, and may so be regarded. In an average job, labor consists of 50% and material of 50% of the cost of the completed work. In a mile of average 18-ft. pavement costing $27,000, the material and its manufacture into the road will represent two-thirds of the total. Each additional inch of concrete will amount to not less than $2500, or from 9 to 10% of the total.

This sum, or a part of it, spent on the labor of more completely preparing the road for its wearing surface, would work wonders. It would provide for 10,000 lin. ft. of drain tile in place, the deepening of the side ditches, the raising of shallow fills amounting to an average of 1 ft. for an eighth of a mile. In designing drainage for city pavements, the total cost rarely amounts to more than 15 or 20% of the cost of the improvement. This includes cement jointed pipe laid at considerable depths, of large size (in place of side ditches) many catchbasins and manholes and, frequently, rather lengthy outlets. It is certainly to be doubted that similarly adequate drainage for a country road would increase the total cost more than 5%, taking into consideration the amount of drainage which it is now customary to provide.

It seems to me that the money spent in this way will go farther toward making a first-class heavy-traffic highway than increasing the thickness of the concrete. Rarely in my experience have failures been caused by lack of depth of the foundation. Even when apparently so, investigation has shown some other primary reason, generally faults in the drainage, but often, also, because of careless mixing of concrete. Our materials are usually first-class, but labor items do not come up to the same standard. For this reason the adoption of the mechanical type of tamper is a long step in advance, and, of itself, reduces the necessity for increasing the thickness of the slab.

Mr. Older, it would appear, passes rather lightly over the necessity for wider roadway widths with the statement that, as a great number of heavy trucks will monopolize the roads, they must be thicker. If the traffic is so heavy, should not the question of greater widths receive more thought? True, a 4-ft. wider pavement would cost considerably more than a 1-in. increase in the thickness, but ordinary traffic is entitled to consideration. Because of heavy traffic and

inadequate revenue, the City of Chicago has for some years imposed a wheel tax, graduated on the size of the vehicle. Should not some such form of tax be equitably assessed on traffic of the kind he has in mind, thus creating a fund to be applied toward the correction of the evil? A highway on which the traffic is so heavy that the pavement requires 10 in. of foundation certainly needs a wide roadway, and would justify almost any expenditure for drainage. How many asphalt city pavements in our heaviest-traffic streets in our largest cities have such a foundation? States St. in Chicago has not, and it has teemed with heavy-truck traffic on an asphalt wearing surface for the past 15 years.

In this discussion much has necessarily been ignored, but the main thought has been to show that as far as the published reasons are concerned, sufficient data have not been submitted to justify the increase in the standard thickness of the concrete, in preference to other methods which may be suggested. A rather cursory study would also seem to indicate that other types of pavement suffer by the Illinois decision, which was not the intention of the department, I feel sure.

Chicago, Ill. PAUL E. GREEN.

[The foregoing letters were submitted to Mr. Older for comment, and his reply to the letters follows.—EDITOR.]

Sir—I have read carefully the accompanying letters commenting on my article on pavement design. E. L. Heidenreich criticizes the design because no reinforcing steel is used. For flexural effect it would be necessary to use such steel in both top and bottom of the slab, as both positive and negative moments occur in every road slab. The negative moment is particularly important adjacent to cracks or joints and the edges of the slab. Even in heavily reinforced pavements built by this department cracks were not avoided. The amount of steel recommended by Mr. Heidenreich would have but little effect so far as increasing the flexural strength is concerned.

The total maintenance cost of concrete and brick slabs from two to six years old in Illinois, including the maintenance of cracks, has not yet reached $40 per mile per year; nor is the maintenance cost of the oldest roads greater than those more recently constructed. Illinois has for years been a leader in the use of reinforced-concrete bridges, and the use of steel in roads has been carefully considered and experimental reinforced sections built, but the use of this material has not been deemed of sufficient benefit in reducing the first cost or maintenance cost, to justify the additional expense.

I am thoroughly in accord with Mr. Green's remarks concerning drainage. The importance of proper drainage cannot be overestimated. The design of the concrete slab adopted by the Mississippi Valley Association of State Highway Departments was, however, considered by the association as being that necessary to support the expected loads on a subgrade drained as thoroughly as a justifiable expenditure will permit. This matter, of course, represents the judgment of the engineers who adopted the design, based on their observation and study rather than upon any theoretical consideration.

In this connection, it should be held in mind that many states, Illinois, included, at the present writing, have absolutely no provisions restricting concentration of loads on their highways.

I also agree with Mr. Green that where the traffic is heavy, wide pavements would largely eliminate the necessity of traffic following distinct lines. The law providing for a bond-issue system of roads in Illinois, however, provides for a maximum width of 18 ft., and, having been approved by the people, is not only irrepealable but cannot be altered in any particular.

CLIFFORD OLDER.
Chief Highway Engineer, Department of Public Works and Buildings.
Springfield, Ill.

Concrete Coating for Steel Floor-Beams To Prevent Corrosion

Sir—In looking over your issue of May 29, I was very much interested in the article on "Scrapping Tons of Good Highway Bridge Metal Because of Local Corrosion." While, at first thought, it seems that the officials in charge of highway maintenance, who, as a rule are not trained engineers, are responsible for not keeping the steelwork properly protected with paint, yet we all know the unfortunate tendency in connection with public work to praise the official who spends whatever money his local board may allow him on the parts of the highway which show, rather than spend it on getting at and cleaning up inaccessible points. The neglect of these, after all is said and done, will not appear for five or ten years after the commissioner is out of office. Such being the case, would it not be wise, both from the engineer's standpoint and also from the standpoint of public economy, to coat the floor-beams thoroughly, and also all parts of highway bridges which are not easily accessible, with concrete? The first cost would be a trifle more, but the saving in expense of cleaning and painting would more than counterbalance this additional first cost, to say nothing of the greatly increased life of the bridge which it would give.

This matter, I understand, is receiving considerable thought from some of the railroad officials, and might, with considerable advantage, be adopted in connection with all road work. There are, of course, cases where this simple protection has been tried with unsatisfactory results, but in these cases the dropping of the concrete was undoubtedly due to faulty details of construction, rather than to any internal weakness in this system of bridge preservation.

I have not endeavored to go into the above in a technical way at all but simply wish to bring up the question, which is very important but of which one, nevertheless, hears very little. A. B. TAPPEN,
New York City. Mitchell-Tappen Company.

Why Not "The Profession of Engineering"?

Sir—In your issue of May 29, 1919, p. 1079, T. L. Condron, chairman of the license committee, Engineering Council, gives a definition of "professional engineering." While the definition in itself seems to meet the requirements of the case, the term "professional engineering" is decidedly objectionable. Why not substitute therefor "the profession of engineering," and begin the definition thus: "The profession of engineering embraces . . . ?" W. CHASE THOMSON,
Montreal, Can. Consulting Engineer.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Pipelaying Cost Is Influenced by Many Conditions on Each Job

CONSTRUCTION cost is influenced by so many local factors that each job must be considered in the light of its own conditions, according to a paper presented at the meeting of the Iowa Section of the American Water Works Association by W. A. Judd, superintendent of water-works at Mason City, Iowa.

For instance, in the laying of a one-half mile stretch of 10-in. pipe in good clay in 1915, the cost of pipelaying was only 5c. per foot, due partly to the fact that the ditch stood up well, and 500 to 600 ft. per day could be laid. Another job in the same year was scattered in short pieces, laying 6-in. pipe at intersections preparatory to paving. Here the cost was 7c. per foot, but excavation prices were lower on account of cooler weather and consequent higher labor efficiency.

On two jobs of laying 8-in. pipe in sandy clay, with an experienced gang in the first case and an inexperienced gang in the second, the costs were 32 and 40c. per yard for excavation, 13 and 16c. per yard for backfilling, and 3.7 and 7.7c. per foot for pipelaying. Weather and soil conditions influence such work, as is shown by records of 6-in. pipe laid behind a trenching machine. One job in wet, sticky clay cost 8.9c. per foot, bracing being needed close behind the machine, while with more favorable weather conditions on a similar job the cost was 6.4c. In good clay and with favorable weather the cost was 4c., but with the best weather of all the jobs, in a sandy trench, the cost was reduced to 3.2c. per foot.

For laying 6-in. pipe on all jobs during 1918 the average cost was 8½c. per foot, this reasonable rate, Mr. Judd explained, being due to the old and dependable emergency gang. On the other hand, earth excavation ranged from 42 to 66c. per yard, as compared with 32 to 40c. in previous years. In 1915 and 1916 labor was plentiful at 22½c. per hour. In 1914 and 1918 it was scarce at any price, and part of the time there was only the emergency crew of five men.

Other Articles in This Issue of Interest to Contractors:

Construction of New Arch Section of Galveston Causeway — Page 1190

Function of Corporate Contract Bonds—How Obtained — Page 1212

Hard-Surface Road Specifications of the State of Illinois (Letters) — Page 1224

Methods of Shifting Pontoons for Walking Dragline Excavators

BY ALBERT S. FRY

Morgan Engineering Company, Memphis, Tenn.

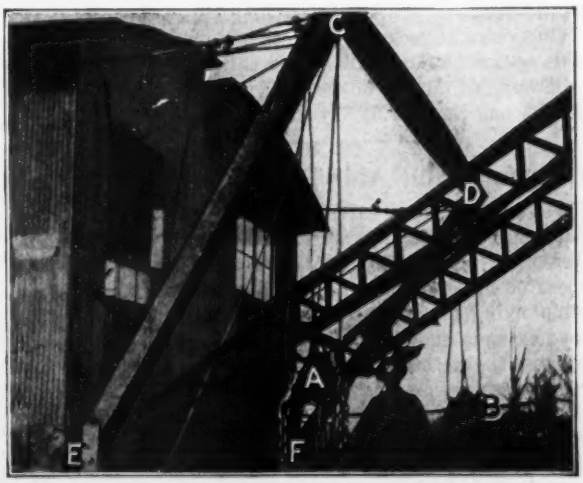
TWO successful methods of handling pontoons for walking dragline excavators were developed in the levee work for the Inter-River Drainage District in Missouri. Four excavators are being operated by the Callahan Construction Co., with J. W. Radford as foreman. The pontoons are 6 x 30 ft., and are built of 3 x 14-in. timbers.

The simpler method of shifting is to hook one end of the pontoon directly onto the bucket bridle. In this case, near one end of the pontoon there is a chain with a hook to be hooked to the bucket bridle. By the hoisting of the bucket the pontoon is raised from the ground, the machine is revolved, the drag cable tightened and the hoist line slacked until the pontoon is maneuvered into position on the opposite side of the machine. In shoving the pontoon up against the last one placed, the edge of the bucket is sometimes brought against the pontoon after it is unhooked and is resting on the ground.

The bucket is hauled in to the machine which pushes the pontoon up tightly against the last one. This practice is looked on with disfavor, however, as the bucket edge tends to damage the pontoon. Although a bit hard on the hoist cable, this method of handling pontoons is rapid and efficient.

An inclined gallows frame on the dragline is an essential feature of the second method. When this method is employed each pontoon is fitted with a U-bolt at each of its four corners.

Two blocks, which are shown herewith at A and B in the illustration, are triple-hitched to hoist cables which pass through sheaves at C and D, thence down to blocks at E and F and thence to a junction with each other in a common hook about midway between E and F. To lift a pontoon, bridle chains from A and B are hooked into the U-bolts. Then the common hook of the two hoist cables is connected to the bucket bridle. Tightening the bucket hoist line raises the pontoon, and the revo-



AUXILIARY FRAME ON DRAGLINE SHIFTS PONTOONS FOR WALKING DRAGLINE EXCAVATORS

lution of the excavator body carries the pontoon to the front of the machine. This method is much more cumbersome than the first and takes more time. After trying out the two methods, Mr. Radford has adopted the first method for all four machines.

In connection with the pontoons, it may be noted that one man is kept busy cleaning mud off the tops; if this is not done the tub of the machine will slip on the mud when the machine moves.

Concrete Used to Line Temporary Diversion Channel

By Glenn D. Holmes

Chief Engineer, Intercepting Sewer Board, Syracuse, N. Y.

TEMPORARY diversion channels, for the unwatering of Onondaga Creek in the City of Syracuse, N. Y., in connection with the extensive improvements of the waterway being made by the Intercepting Sewer Board, are being constructed of concrete by John Young, the contractor. It was intended at first to construct these diversion channels of timber, but when excavation for them was opened up, well graded sand and gravel suitable for concrete was encountered, which led to the change in plan. The adoption of concrete resulted in a saving in width of excavation, and ordinary rather than skilled labor could be employed for the construction.

CONCRETE-LINED DIVERSION CHANNEL AT SYRACUSE

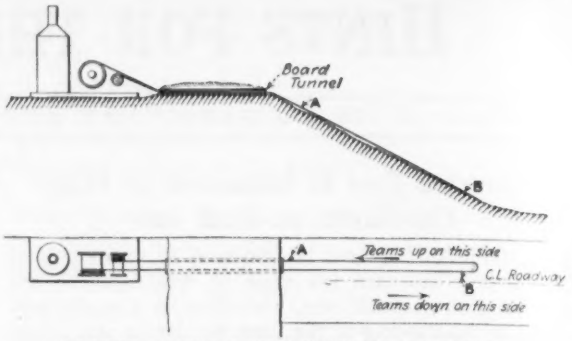
There are two of these channels, each about 1200 ft. in length. They will divert the water to the large storm sewer and around the work of construction. The larger of these channels is rectangular in section, 6 ft. wide and 3 ft. high, and has a capacity of about 250 sec.-ft. The smaller channel is U-shaped in section, 45 in. in height and top width, and has a capacity of about 50 second-feet.

Onondaga Creek has a drainage area of about 100 square miles. Its dry-weather flow reaches a minimum of about 50 sec.-ft. and its maximum discharge has reached 5500 cu.ft. per second.

Snatch Cable Aids Teams on Steep Grade

TEAMS hauling earth from a portion of the river-channel widening work being done at Columbus, Ohio, are helped up a 15% grade by a snatch rope operated by a double drum hoist, as indicated by the accompanying diagrammatic sketch. From one drum the rope extends down the hill, and there makes a loop and returns to the other drum. By alternate forward and reverse operation of the drums the hitches at A and B see-saw up and down hill, one always being at the bottom when the other is at the top. From the drums the rope passes under the roadway through a small plank tunnel.

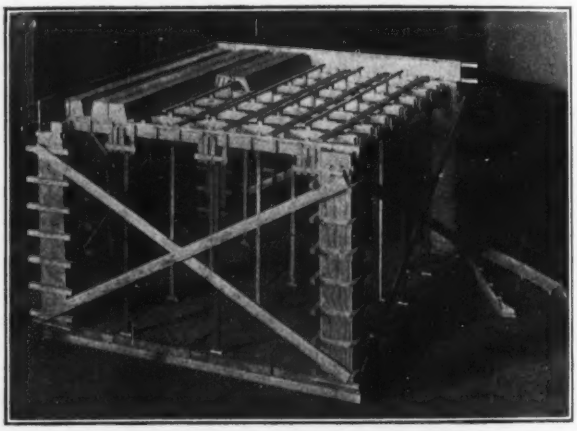
When a loaded team comes from the shovel to the bottom of the hill the driver makes a chain hitch from the cable to the rear axle and the load is snatched up the incline; the team is thus relieved of all work of pulling.



LOOPED CABLE HAULS WAGONS UP INCLINE

Model of Typical Concrete Form Section Helps Contractor

IN BUILDING a new reinforced-concrete apartment house at Salt Lake City, Utah, Villadsen Brothers, Inc., the contractors, introduced a number of novelties in the design of the forms. Previous to the construction, the firm built the small-scale model of a typical form panel shown in the accompanying view. This was



MODEL ON SCALE OF 1½ INCHES PER FOOT

on a scale of 1½ in. to the foot and reproduced in precise detail the intended structure. The contractors state its cost was negligible compared with the total form cost, but that it has proved of great assistance to the form designers in studying the most economical connections and in forecasting the stripping of the forms.

It is also stated that the model has proved even more valuable, since the construction was completed, in the analysis of all suggestions and criticism following the actual work.

New York Wages Doubled in Four Years

A report issued by the New York State Industrial Commission states that during the four years since March, 1915, wages have increased on the average 107% and the number of employees 18%. In March, 1919, there were 9% fewer workers in the factories in the state than in the same month in 1917, but the payrolls were 27% larger.

Progress Report of Development Committee of American Society of Civil Engineers

Statement of Fundamentals on Which Views of Members Are Desired Includes Relations with Other Societies, Internal Relations and Local Associations, Technical Activities and Public Service

(By Wire from Minneapolis)

UNDER date of June 16, the development committee of the American Society of Civil Engineers, after a four-day session at Minneapolis, presented to the board of direction a report expressing certain fundamentals which the committee anticipates will form the basis of its ultimate report. The committee, desiring to learn the views of the membership on these fundamentals, suggested to the board that it take steps to secure these views. Accordingly, the board ordered the report printed for distribution at the business meeting of the society in Minneapolis the following day.

The report also carried the information that a committee of three, consisting of Gardner S. Williams, George G. Anderson, and Richard L. Humphrey, had been appointed to serve on a conference committee, with representatives of the development or aims committees of the national societies of mechanical, electrical and mining engineers.

The report in full follows:

The basis of the report herewith is the work of the four subcommittees which were appointed at the November meeting, and the main subdivisions represent approximately the scope of the subcommittee work.

A. Relations with Other National Societies and Related Organizations

It is the opinion of your committee that the identity of the four existing national societies should be preserved. The committee believes that the American Society of Civil Engineers should continue to pursue the objects for which it was formed as expressed in the constitution, namely, "the advancement of engineering knowledge and practice and the maintenance of a high professional standard among its members," and that it should devote its chief endeavors to the performance of these objects.

We feel, however, that the time has now come when this society should adopt the principle of becoming an active national force in economic, industrial and civic affairs.

This can only be done effectively, however, by active coöperation with other engineering organizations of the country. To this end the committee recommends that a comprehensive organization be formed embracing:

The local affiliation of the branches of the national technical societies and the local technical societies;

A state council composed of representatives from the local affiliations;

A national council consisting of representatives of the national technical societies and from the state council or state group organizations, in lieu thereof.

The object of the council shall be to increase the usefulness of the engineering profession, to bring about greater coöperation and to advance the welfare of engineers.

The council shall have an executive committee, shall maintain a central office and shall hold at least one meeting each year. It would be desirable that a bulletin of general engineering interest be published by the council. The council shall be supported by a per capita contribution or in such other manner as may be determined.

B. Internal Relations and Local Associations

Your committee makes the following recommendations:

Local Associations—That every member of the society be a member of a local association.

That there be created in each geographical district of the society an organization consisting of representatives of the local associations in that district.

That local associations and district organizations shall operate under uniform constitutional provisions to the extent only that the same are necessary or desirable to insure uniform relations with the society.

That the representatives of each district on the board of direction and the nominating committee of the society be elected by ballot by the corporate members resident in such district.

That it be the duty of each director to visit each local association in his district at least once during each calendar year.

That the nominating committee select candidates for the offices of president, vice-president, and treasurer, the election of which officers shall be by the ballots of the corporate members.

That there be an annual conference of representatives from the local associations for the purpose of discussing the welfare of the society and its members.

That there be allotted a percentage of the dues of the society to each district organization and each local association for the payment of their expenses.

That the board of direction refer for recommendation each application for membership to the local association in whose jurisdiction the applicant resides.

That the present provisions of the constitution relating to the discipline and expulsion of members be so revised as to make them more effective.

That it be the obligation of each local association to bring about within its territory a close affiliation of all branches of the national and of the local technical organizations for the purpose of advancing the status of the engineer.

That in communities where members are too few to form a local association, it be their obligation, in addition to that of their district local association, to affiliate with the resident members of other technical societies, and other engineers, where such affiliations will promote the organization of a local affiliate body.

That the local affiliations be the basis for comprehensive state and national organizations.

Rearrangement of Grades—That the grades of membership be more clearly defined and that changes be made in the grades of associate and fellow.

Student Societies—That it be the duty of the local associations to organize and assist student engineering societies in neighboring engineering schools, to provide carefully selected speakers, and to maintain personal contact with such societies.

(Note: The above is recommended in lieu of establishing the grade of student member and of establishing student branches.)

Young Men of the Profession—That it be the duty of the local associations to provide for the welfare of the younger members of the profession by:

1. Reasonable representation on the active committees.
2. Encouraging their discussion of the general problems of the society.
3. Arranging excursions to works of engineering interest.
4. Promoting social intercourse between them and the older members.

Personal Service—That a personal-service bureau be maintained by each local affiliation, so organized as to operate in connection with a central service bureau to be maintained by the national council.

American Engineers in Foreign Service—That it be the duty of members resident in foreign countries outside of North America to form associations and to promote an

affiliation with the resident members of other American technical societies.

That the board of direction consider the feasibility of keeping on record, and providing to American consuls abroad, the names, addresses and brief professional qualifications of members of the society resident abroad.

C. Technical Activities

Meetings—That local associations should hold not less than four stated meetings per year and encourage joint meetings with kindred societies.

That the fortnightly meetings of the parent society should be discontinued.

That the semi-annual meetings of the parent society should be supplemented by the addition of a spring and fall meeting held successively in different sections of the country under the auspices of a local association.

Papers—That the present system of securing papers depends wholly upon voluntary offers and results in a limited variety of subjects. Committees of the parent society and local associations should be formed and charged with the responsibility for promoting greater activity and discussions. Simultaneous discussions of important papers by local associations is desirable.

That the use of the monthly *Proceedings* should be extended to include editorial work, abstracting and reviewing important engineering articles and subjects of popular interest to the great majority of engineers.

Committees—That there be created advisory standing committees of the board to promote the study of important engineering subjects and charged with outlining and coördinating the work of like committees of the local associations. Three members of the board should constitute a standing advisory committee on each subject. Local associations should urge the younger members to identify themselves with local committee work.

That local associations should suggest names of volunteers possessing necessary qualifications for special committee service, and that tenure of committee membership shall terminate automatically on account of absence or inactivity.

That the society support an active program of research work, coöperating, if practicable, with existing research agencies.

That the chairmen of the standing advisory committees of the board should constitute the publication committee.

That to effectively carry out the intent of these recommendations a technical editorial staff under the direction of the publication committee should be established.

Sections or Divisions of the Society for Specialized Lines of Work—It is not recommended that the work either of the parent society or the local association be divided in this way. The object apparently sought by such divisions will be better met by the work of strong committees.

Coöperation With Specialized Engineering Societies and Other Organizations—Much of value has been accomplished in the past in this way and it is recommended that such work be continued and extended.

Standards in Engineering Practice—There exists at the present a committee known as the American Engineering Standards Committee, composed of representatives of the national engineering societies. This line of coöperation and advice is approved, and it is recommended that it be continued and extended, but the idea of developing this committee into another association is deprecated.

It is recommended that a book of recommended practice and standards be compiled which shall be revised periodically to follow the development of engineering.

D. Relation to Public Affairs

Definition of Engineering—That the three main ideas in a complete definition of engineering should be as follows:

1. A general and descriptive statement.
2. The content of the profession—the things that engineering does.
3. The aims and motives the profession should have.

Ethics—That a short code of ethics of broad scope, general character, and positive rather than negative injunction, be prepared.

Engineering Education—That a standing committee of seven be created to consider questions of educational policy, and offer advice and guidance in carrying out such policy. The aims of engineering education, fundamental requirements, changes in curricula indicated by changing social and industrial conditions, the qualifications of teachers, and the standardization of degrees, are a few of the topics which such a committee should rightly consider. Further, that local associations appoint similar committees of three or five to coöperate with educational institutions in their respective territories.

Licensing—That the society, in coöperation with the other founder societies, prepare a standard form of bill for the licensing or registration of engineers, to be used in the framing of legislation.

Arbitration and Expert Testimony—It is the belief of the committee that the present practice with regard to expert estimony and arbitration is not satisfactory, and it is recommended that a committee of the American Bar Association be asked to coöperate with the joint committee from the four founder societies, in order to develop better practice along these lines.

Publicity—It is recommended that the preparation of general articles on engineering subjects be encouraged and assisted by the profession, especially with a view toward having such articles published in the standard magazines.

Washington Agency Recommended

Legislation and Development of Natural Resources—It is recommended that the national council maintain an agency in Washington, D. C., or elsewhere, for the purpose of keeping advised of all proposed Federal legislation and departmental rulings and regulations involving, directly or indirectly, questions of engineering; and that such agency keep the society or its locals advised from time to time of such matters. It shall also be the duty of the various locals to keep advised on all proposed state legislation affecting engineering matters, and the said locals shall actively interest themselves to the end that proper legislation may be enacted. It is also recommended that such agency, and the state and national councils, shall keep advised as to the proposed creation of Federal and state commissions, whose activities may affect engineering enterprise; and that the influence of the locals and the society at large shall be directed toward securing the appointment of engineers upon such commissions.

The Service of the Engineer to the Community, State and Nation—The engineering profession owes a duty to the public which it is believed can best be discharged by the active participation of every engineer in the civic work of his locality. To this end it is urged that the engineer join the civic body of his community, and, if there be no such organization, that he should then endeavor to organize the community for civic work, in sympathetic coöperation with the governing body. The engineer's duty to the public also requires that he give his best efforts to matters of state, interstate and national character, calling upon the various engineering bodies for assistance and coöperation when necessary.

Patent Law—Inasmuch as a nation-wide society of inventors has been formed, composed largely of engineers, one of whose objects is to handle the subject of patent law, it is recommended that no action be taken on this subject at the present time.

Coördination of Government Activities—It is recommended that the influence of the entire membership of the society be directed toward the creation of a Federal Department of Public Works, the secretary of which shall be technically qualified and a member of the President's cabinet, and that the law creating such department shall provide for the coördination of all Government engineering activities.

Industrial Affairs—That fundamentals of industry and their inter-relations are based on engineering principles which form a part of the education of the engineer.

NEWS OF THE WEEK

New York, June 19, 1919

$200,000,000 French Contract to American Firm

Vulcan Steel Products Company Engaged to Rebuild Nancy District—Large Organization Required

That the Vulcan Steel Products Co., 136 Liberty St., New York City, has just received a cost-plus contract, valued at $200,000,000, for rebuilding the Nancy district of France, was made known to a representative of *Engineering News-Record* yesterday morning in an interview with the officer of the Vulcan Co. who arrived here this week, after closing the contract in France. Plans for a part of the project are on the way to the United States. The preliminary work of accumulating an organization and obtaining bids on machinery and equipment of all kinds will be started at once, so that the actual construction work may go forward the moment the peace treaty has been signed. Another retarding factor is the present high rate of exchange.

Associated with the Vulcan Steel Products Co. are MacArthur Brothers and the McClintic-Marshall Co., which will handle the construction work. French labor will be used, and it is understood that preference will be given to French manufacturers of machinery. However, a vast amount of American machinery will be bought.

Industrial Needs Paramount

Although the contract covers all classes of construction, particular attention will be devoted to industrial works, because of the revenue they will produce. For example, it is estimated that 5000 breweries have been destroyed. If only 20% are rebuilt, it will mean a thousand such plants. In that event it is quite likely that some American manufacturer of brewing machinery will become associated with the Vulcan Co. The same may happen in connection with the cement, textile and other industries. It is possible that a French company will be formed to handle the work over there for the Vulcan company.

Some time ago newspaper despatches stated that Europe intended to do its own rebuilding, without foreign assistance. It is now recognized that the task is far beyond the capabilities of post-war Europe. The plans for reconstruction are prepared by local committees. The French Government recognizes these committees as being responsible bodies. The Nancy contract was let by the committee in that district.

Report of Development Committee Discussed at Civil Engineers' Convention

Committee To Draft Another Report Before November 1, Based on Views of Members—Lively Two-Hour Discussion

(By Wire from Minneapolis)

Delayed two years by the war, the forty-ninth annual convention of the American Society of Civil Engineers convened in Minneapolis June 17. The main topic of the business session was the development committee's report.

At the opening session the visitors were welcomed by Governor Burnquist, and the president delivered the annual address (given in full on page 1208 of this issue). He was followed by Francis C. Shenehon, who in an address of singular charm spoke of the engineering features of the Twin Cities and their tributary territory.

Prompt Action on Report

The afternoon session, except for some routine announcements, was given over to a discussion of the development committee's report, which, though presented only the day before to the board of direction, had been put into type and distributed to the members. In presenting the report the secretary announced that the board desired that it be given careful study by the members and that they communicate their views to the chairman or the secretary of the development committee as early as possible. It is the hope of the board that the response will be such that the committee will be able to draft a subsequent report, final or progress, and submit it to the board by Nov. 1. That will allow of its distribution in ample time to have full discussion thereon at the annual meeting in January. (The report in full will be found elsewhere in this issue.)

Despite the fact that the weather was sweltering, and that the members one by one discarded their coats until all were coatless, including the president, discussion of the report continued for full two hours. In general, there was indorsement of the fundamentals laid down by the committee, and in every case full appreciation of the great amount of work done by the committee in drafting the document. The members of the development committee, on request of the chair and voluntarily, gave emphasis to certain sections of the report and enlarged on the committee's reasons for the recommendations.

Gardner S. Williams, of Detroit, expressed the view that two chief features of the report were the recommendations: First, that of election of directors by districts and the district organization scheme, and, second, that the society retain technical matters as its chief function, leaving to a separate system of organization the civic and welfare activities.

Robert A. Cummings, of Pittsburgh, pointed out the very distinct departure in the philosophy of the organization involved in the building from the bottom up in the plan for civic activities. The organization for technical work, on the other hand, he felt, is properly built from the top down, since technical work necessarily involves standards which are set at the top. Prof. George F. Swain, of Boston, felt that the section on licensing gave implied approval of the licensing idea with which, he said, he was not in agreement. He thought that a code of ethics should be negative in statement, and brief.

Lewis D. Rights, of New York, raised the question of the method of obtaining funds for the proposed enlarged activities. He asked whether an increase in dues to $25 for all members should be considered, and stated that the publication committee had thought of proposing to raise revenue by inserting advertising in the *Proceedings*. To this question of raising funds George G. Andrews, of Los Angeles, made answer that he felt certain the needed funds would be forthcoming when the members received the large measure of service provided for in the recommendations.

Needs of Young Men Discussed

William Anderson, as did other members, stressed the need for making adequate provision for the young men—in fact, no section of the report received such repeated emphasis. On the question of licensing, Mr. Anderson believed the society must meet it eventually and should address itself immediately to the problem in order to meet it with the greatest intelligence.

Charles Hansel, of New York, speaking of the section on the civic duties of the engineer, urged that, however it might be rewarded, it should carry the thought that each engineer had a duty as a citizen to become a member of the civic association of his community.

Following the program of the meeting, as outlined, the president's reception was held Tuesday evening. The other events of the meeting promised to be well attended, a large number having signified their intention of making the trip to Duluth and the iron range at the week end. E. J. M.

Southwestern Water Works Annual Meeting in Kansas City

The eighth annual convention of the Southwestern Water Works Association, to be held in Kansas City, Mo., June 23-26, as previously announced in these columns, will be devoted largely to round-table talks bearing on various current water-works problems. They will include practical five-minute talks by superintendents and members of the association on difficulties that have arisen in their experience, and methods for overcoming them.

Among the formal papers that will be presented at the meeting are: "Some Economies That May Be Effected in the Operation and Maintenance of the Water-Works System," by Homer V. Knouse, of Omaha; "Water Purification and Treatment," by D. H. Hunter, of St. Louis; "Sterilization of Water and Sewage," by Dave Morey, Jr., of Dallas, Texas; "Municipal and Private Utilities Versus the Consuming Public," by Charles Ade, of San Antonio, Texas; "What Constitutes a Water-Works System," by Clarence E. Ridley, of Port Arthur, Texas; "Waste Control by House Inspection with District Metering," by E. W. Case, of New York.

The round-table talks will include discussion of such subjects as benefits to be derived from monthly and quarterly reports by superintendents to their boards, monthly meetings of all employees to further coöperation, and cost of meter upkeep.

The Railroad Administration has granted a special round-trip rate, for delegates, amounting to 1½ one-way fare.

Changes in Texas Health Board Recommended

Recommendations for a department of sanitary engineering in the Texas State Board of Health, appointment of an experienced sanitary engineer as one member of the board, and a six-year term for board members, are included in the report of the Texas Public Health Commission appointed by Governor Hobby in November, 1918.

More Aqueduct Power Bonds

Aqueduct power development will proceed at Los Angeles, following a vote on June 3 of some 46,500 to 21,200 in favor of the issue of $11,000,000 bonds for municipal purchase of the distributing system of the Southern California Edison Co. and $2,500,000 for power-plant extensions along the aqueduct. The voters also authorized the sale of surplus power by the city to outside communities.

Contributions by Engineers, Architects and Constructors' Conference on National Public Works

M. O. Leighton, Chairman.

PUBLISHER'S NOTE: The space occupied under this caption is donated to serve as a means of frequent and intimate communication between the Engineers, Architects and Constructors' Conference on National Public Works, and the members of the profession. The contributor takes full authority for the statements made.

The Reply of the Corps of Engineers, United States Army:

The long-expected response of the Corps of Engineers, United States Army, to the activities of the engineers, architects and constructors of the country looking toward the establishment of a National Department of Public Works, has been made. It is in the form of a bill designated S. 1376, 66th Congress, First Session, introduced into the Senate June 5, 1919, by Senator Ransdell of Louisiana. It may be inferred that this senator is not prepared to father the measure, for the customary legend at the head of the bill contains the additional words "by request," after Senator Ransdell's name.

The bill is 35 pages long and contains 29 sections. It proposes to create an "Auxiliary Engineer Corps" in the United States Army for duty on works of public improvement—a noncombative corps of engineers which shall be "under the command and direction of the Chief of Engineers, U. S. A. . . . Its personnel shall be assigned by the Chief of Engineers to duties under his charge; specifically, on river and harbor improvements, inland waterways, locks and canals, fortifications, embankments, levees, dikes, breakwaters, piers and in the supervision and *in the construction of* national highways and bridges, and to any other public work that shall be now or hereafter assigned to the Chief of Engineers under the War Department. This organization shall also perform the duty of guarding and protecting all national public works."

Whether or not the foregoing language places the construction of national highways and bridges under the Chief of Engineers and thereby increases the authority of the Engineer Corps beyond that now conferred upon it is a question for the lawyers to determine. It may be observed, however, that, even if such authority is not specifically conferred, the language creates an "open sesame" and one is reminded of the ancient legend concerning the camel who received permission to place his nose in the tent. The bill is too long and comprehensive to be reviewed adequately here, but those who read it will have no question that it is the first step in the attempt, of which many of us have been aware, to militarize the public-works functions of the Federal Government.

The Engineers, Architects and Constructors' Conference on National Public Works took action at the recent Chicago meeting directly opposite in spirit and purport to that proposed under S. 1376. Therefore, the officers of this federation are in duty bound to oppose this bill. In order that the engineers, architects and constructors of the country may be informed concerning the first steps taken in opposition, the letter from the chairman of the conference to the chairman of the Senate Committee on Commerce (the Hon. Wesley L. Jones is chairman of the committee), to which the bill has been referred, is reproduced below:

MY DEAR SENATOR JONES:

One June 5 Senator Ransdell introduced into the Senate, "by request," a bill to create an Auxiliary Engineer Corps in the United States Army for duty on works of public improvement. It is numbered S. 1376 and has been referred to the Committee on Commerce.

I have the honor to be chairman of a federation of societies with an aggregate membership of 105,000 engineers, architects and constructors. This federation, which is known as the "Engineers, Architects and Constructors' Conference on National Public Works," is opposed to the provisions of the bill above-named, and at its convention in Chicago, Apr. 23-25, adopted a program contrary thereto in all respects.

On behalf of the federation aforesaid, I respectfully request that when the Committee on Commerce designates S. 1376 for hearing, said federation be given an opportunity to prepare and present its views.

For more than forty years the engineers, architects and constructors of the United States have almost unanimously been advocating the consolidation of the engineering and construction work of the Government into a Department of Public Works. The United States stands practically alone among the great and small nations of the world in that it has no such department. The matter has been considered and acted upon from time to time by various engineering societies throughout the country, but all efforts have heretofore been futile, for two reason: (a) The engineers, architects and constructors of the country have given local and sporadic rather than united and continuous support; (b) the Corps of Engineers of the United States Army has always been able to defeat any proposal that has thus far been advanced to Congress. The engineers, architects and constructors of the country are now united, and they propose to present to Congress in the near future a well considered plan for a Department of Public Works that will correct the present chaos in our national construction matters and achieve economy and efficiency.

I will not burden you now with a detailed statement of the reasons which, after more than forty years of mature consideration by well balanced men, prompt the forthcoming recommendations. With respect to S. 1376, we shall in due time endeavor to substantiate our belief that there is no more sure, certain and insidious way of accomplishing militarism in the United States than through the militarization of our public works. Heretofore, this militarization has extended principally to the rivers and harbors operations, with results that have repeatedly been characterized in a way not at all favorable to the Corps of Engineers. The bill S. 1376 extends Army control to public roads, bridges "and any other public work that shall be now or hereafter assigned." This bill is merely a part of a very ambitious plan to place the Army in the saddle over all engineering operations of the Government.

The genesis of S. 1376 is well known. You will find attached hereto a sample of propaganda circulated among the civilian force of the Corps of Engineers through the district office in New Orleans. It is hardly necessary to remind one as familiar with official Army procedure as yourself that no civilian attached to the Corps of Engineers would be so venturesome as to distribute this amazing circular without "knowledge and consent" of headquarters at Washington.

It is a very long way from the War Department to the capitol if one goes via

(*Continued on page* 1234)

To Arbitrate Jurisdictional Building Strikes

Engineers, Architects, Contractors and Labor Unions in an Agreement to Prevent Source of Trouble

Organized labor, through the American Federation of Labor, has joined with the large building employers' association, the American Institute of Architects, and Engineering Council, to form a board to arbitrate the so-called jurisdictional strikes which make up so large a part of the labor trouble in building operations. This board is to be known as the National Board for Jurisdictional Awards in the Building Industries, and consists of eight members, three to be selected by the building-trades department of the American Federation of Labor, and one each by the American Institute of Architects, Engineering Council, the Associated General Contractors of America, the National Association of Builders' Exchanges, and the National Building Trade Employers' Association.

Against Sympathetic Strikes

According to the constitution which was drawn up and adopted at the recent meeting of the American Federation of Labor, the duties of the board shall be to hear claims for jurisdiction over work performed by building trades and to determine by which trade the work in contention shall be performed, and to make an award in conformity with the facts submitted by the contender. At least a two-thirds majority of the voting members of the full board shall be required to render an award, in all cases.

The constitution as adopted further provides that when a dispute arises, the employer to whom the work has been given shall proceed with such workmen as in his judgment he may see fit to employ, pending a decision of the board, but the right of any contestant to the dispute shall not be prejudiced in its claim for a final award. Each signatory to the agreement agrees that the membership of its organization shall not take part in sympathetic strikes in any case of jurisdictional dispute. The constitution further provides that local organizations signatory to the agreement shall secure the enforcement and compliance of their organizations with the provisions of the agreement and the awards of the board. Local organizations refusing compliance with the provisions of the agreement and the awards of the board are to be suspended from their international organization, and the international organization shall proceed at once to man the job and the employer shall coöperate with the international organization in so doing. Any architect, engineer or employer represented on the board through an organization signatory to the agreement shall be suspended from his organization upon failure to comply with the provisions of the agreement and the awards of the board.

Water Purveyors Hold Thirty-Ninth Convention

American Water Works Association Reviews War Conditions and Looks Into Future—Rates, Prices, Hydrant Damages

Goodly numbers in attendance, a wieldy program well handled, an unusually large and varied exhibit of water-works appliances, a notable committee report on private fire protection services, much attention to war and after-war phases of water-supply, and a paper giving promise of a new and unique reciprocating pumping engine, were features of the convention of the American Water Works Association held in Buffalo last week. A number of the papers read are abstracted on pp. 1193-1198.

Effects of the War

Impressions left by a review of some five hundred court and commission decisions affecting water-works were presented by Leonard Metcalf, consulting engineer, Boston, Mass. Summarized, these impressions were:

"Public ownership is less attractive to the people in light of recent experiences." Commission jurisdiction is becoming more complete. The tendency is for the commissions to consider original cost "the fairest measure of value," but "many competent observers believe that past valuations or rating bases have frequently been too low." The older commissions generally recognize going value. Franchise values have shrunk materially in this as compared with the previous decade. The treatment of depreciation "has improved immensely." There is a marked improvement in the distribution of the water-works burdens between private consumers of water and the general public.

A review of water-rate decisions given in "Public Utility Reports Annotated," for 1915 to 1918, shows increases granted to four plants in 1915, 12 in 1916, 15 in 1917 and 67 in 1918. The lag between mounting expenses and grants of rate increase was 12 to 18 months. Although there were many substantial increases, commissions did not grant relief from increased war burdens to utilities generally.

The larger part of Mr. Metcalf's paper was devoted to a somewhat detailed study of the effect of the war upon water-works revenues and expenses. That portion of the paper appears in abstract on p. 1193.

In the course of the discussions on Mr. Metcalf's paper, R. B. Howell, of the Omaha Water District, said that 1917 was a very prosperous year for his works. Although rates were again reduced, a profit was shown. After questions by various members had been answered by Mr. Howell, it was remarked by J. N. Chester, of Pittsburgh, that the secret of Omaha's success is that it has municipal ownership under the sort of management more common to private ownership. Mr. Chester also stated that rate increases depend more upon political conditions than upon the necessities of the case. J. W. Ledoux, of Philadelphia, and others, complained of the slowness of the utility commissions in rate cases.

Besides the data and opinions given in Mr. Metcalf's paper, Charles Wood, of Philadelphia, submitted a number of opinions gathered by him: A representative of the manufacturers of cast-iron pipe reported that there had never been a time when the stock of water and gas pipe was so low as now. The president of one of the largest cement companies said cement has fallen at some points and there may be a further decline, but it is safe to say that the price of cement will never go down to its old level.

High prices, he added, are world-wide and apply to all commodities. The editor of *Iron Age* called attention to the large percentage of labor entering into the cost of pig iron, which makes against the lowering of the prices of this commodity.

New Price Level Now

Still another summary was presented by Edgar A. Buttenheim, editor of the *American City*, who said that the gist of the results of his investigations is that although there are all kinds of water-works construction in sight, there is too much disposition to wait a little longer in hopes of lower prices. It must be realized that we are on a new and higher scale of price levels. Dennis O'Brien, of the A. P. Smith Manufacturing Co., said that a questionnaire sent to members of the Water-Works Manufacturers' Association disclosed much independence of thought on prices. There is an undoubted feeling abroad that if one waits long enough a considerable reduction in prices will be seen. In opposition to this the economists, reasoning from the volume and movement of the circulating medium, predict continued high prices. The plain business man sees loss of laborers through war and immigration, high cost of transportation, and a demand for goods to make up for slackened production and normal increase. The shelves of the country are bare. Labor prices will go up rather than down. So, finally, the business man reaches the same conclusion as the economist.

Maj. E. C. Church, U. S. A., of New York City, urged that attention be given to deferred maintenance, which should now be taken up even if prices are high.

Instead of the association having a "Superintendents' Day," parts of several sessions were set aside for the discussion of subjects of appeal to the superintendents, and ample opportunity was afforded for question-box discussions.

The net result was small except under the set topic, that of damages to fire hydrants by motor vehicles. This was

opened by W. W. Brush, of New York City, who said that nearly 400 hydrants out of a total of 40,000 are damaged yearly by motor vehicles in his city. Repairs are generally made by removing and welding the standpipe. Welding alone costs $6 when done by the city and $8 or more when done in a private shop; digging up and resetting the hydrant, yard assemblage and cartage bring the total cost of repairs up to $25 to $30. There have been breaks where the hydrants were provided with fenders. In fact, protection against the heavy motor trucks now in use seems impossible. F. W. Cappelen, of Minneapolis, said fenders had not been successful there. His hydrant breaks due to motor vehicles had been 1 to 150 hydrants. Most of the breaks had been at street intersections. No one present seemed to favor the use of either flush hydrants or hydrants at the building line.

Brief Mention of Papers

Filtration of the Buffalo water-supply, said Henry F. Wagner, must wait for a reduction of the present excessive consumption, after which mechanical filters may be built on land near the pumping station, now partly under water. Some air-lift pump installations and the use of the air lift in connection with water treatment, where aëration is needed, were described by John Oliphant, of the Sullivan Machinery Co., Chicago.

Army and related water-supplies received an entire session. W. H. C. Ramsey, designing engineer, outlined the principles used in design, and described in detail the water-supplies of the many housing projects of the United States Shipping Board. Lieut. Col. Dabney H. Maury stated that the water-supplies of our cantonments and other camps served 4,000,000 troops and 2,000,000 civilians, without a single known case of water-borne typhoid, and with a very low fire loss. Lieut. Col. F. W. Scheidenhelm told how water was provided for the First Army while at the front in France. These three lantern-slide talks having held the attention of the convention through a whole session, the fourth paper scheduled for that sitting was thrown back to the next day, when William J. Orchard, manager Wallace & Tiernan Co., Inc., New York City, described the motor-mounted water-purification plants and laboratories used at the front—to which, it may be noted, Colonel Scheidenhelm gave praise.

Although the aim was to provide only 2 gal. of water to each man at the front, and sometimes only a fourth of that could be delivered, the task was not a small one, according to Colonel Scheidenhelm.

In the St. Mihiel drive the number of men supplied with water was 30 times as large as the civilian population of the district. The general plan followed was to have reconnoissance parties locate and test available supplies in advance of the occupation of a district. Collecting and distributing centers were called "water points." Here water, provided by gravity or pumping, and treated as might be necessary, was delivered to water tanks or cans on motor trucks, or other vehicles, or in some cases to tank cars running on light railways. The water so hauled was delivered directly to the soldiers or else to improvised storage, sometimes holes in the ground lined with tarpaulin; or canteens might be filled from storage tanks supplied by gravity or pumping. Under still other conditions, Lister bags, mounted on tripods, were used for the disinfection of water and its delivery to canteens. Soldiers in trenches were supplied from large water bags which were carried on the backs of men.

Reports of Special Committees

Had it not been for the valuable monograph designed to be the final report of the committee on private fire protection service, submitted for the committee by Nicholas S. Hill, Jr., chairman, the past year would have been almost barren of results so far as the technical committees of the association are concerned. This report makes an illustrated pamphlet of 58 pages. The various physical and financial questions involved are reviewed, and specific recommendations as to each are made. Much hearty commendation of the report in general followed its reading. Objections were made to some of the conclusions. In order that these objections, as well as written discussions yet to be received, might receive full consideration, and the whole be crystallized and the association take a final and positive stand on this vexed subject, which for years has occupied much of the time of conventions, it was voted to continue the committee, instead of adopting the report and discharging the committee, as the latter had proposed.

In behalf of the American Committee on Electrolysis, Alfred D. Flinn and Edward E. Minor submitted a progress report. The joint committee representing various utilities has conferred with the Bureau of Standards. A technical subcommittee has been created, and a plan has been formulated under which experts would be engaged to study electrolysis. The committee proposed that the American Water Works Association authorize the employment of an expert, but the matter was referred to the executive committee for consideration, in view of possible risks of commitments that might affect litigation.

The committee on revision of standard specifications for cast-iron pipe reported that no meeting has been held during the year but that it hoped to submit something for consideration next year.

The committee was continued, as was also the committee on form of contract and bond.

A canvass of ballots showed that a total of 382 votes had been cast for new officers, with almost unanimous choices, as follows: President, Carlton E. Davis, chief of the Bureau of Water, Philadelphia; vice president, Capt. M. E. Worrell, Q. M. C., formerly of the Meridian, Miss., water-works; treasurer (reëlected), J. M. Caird, chemist and bacteriologist, Troy, N. Y.; trustees, W. H. Randall, superintendent of water-works maintenance, Toronto, Ont., and F. C. Jordon, secretary of the Indianapolis Water Company.

Montreal was selected as the next meeting place, its chief rival being Detroit.

The financial condition of the association was reported as being favorable. The investment fund has reached $13,000. During the year which ended Mar. 31, 1919, there was a net loss of 39 in membership, attributable to the war. The membership on that date totaled 1241, of whom 1024 were active, 91 corporate, 121 associate and five honorary. Taking figures compiled as of September, the membership for the past five years has been 1136, 1229, 1361, 1360, 1308. Geographical sections on Apr. 1, 1919, were: Canada (not officially organized), California, Central States, Four-State (parts of New Jersey, Pennsylvania, and all of Maryland, Delaware and the District of Columbia), Illinois, Iowa, Minnesota, New York State (with part of New Jersey). The committee recommended that state sections be organized wherever the state membership was as many as twenty.

Report on the "Journal"

The publication committee reported that after several months' effort it succeeded in getting original contributions for the *Journal*. The social value of association membership is not sufficient to hold members. It was recommended that a larger amount of original matter be secured for the *Journal* and that it be published six instead of four times a year, at an estimated cost of $7500 a year. This was approved.

A ride on the lake with a visit to one of the Buffalo pumping stations was provided by the City of Buffalo. At the station a 3,000,000-gal "Unaflow" pumping engine (see p. 1193) was seen in operation. A trip to Niagara Falls, a smoker, and special entertainment for the ladies were provided by the Water-Works Manufacturers' Association, Charles R. Wood being chairman of the entertainment committee. Another committee of the same association, with Burt B. Hodgman as chairman, deserves special mention for the unusually large and varied exhibit of water-works appliances.

Conference on Public Works

(*Continued from page* 1232)

New Orleans. The engineers, architects, and constructors of the country are coming to the doors of Congress very soon, with a respectful petition which will be the result of forty years of the best engineering thought. But, in so doing, we shall remember the fundamental engineering axiom that a straight line is the shortest distance between two points.

Reference in the foregoing letter to organized propaganda will be made

clear by the following reproduction of the circular sent out from the district office of the Engineer Corps at New Orleans:

Strictly Personal

1. The purpose of this letter is to enlist all chief clerks in the United States Engineer Service in a "push" to shove a bill through Congress for mobilizing an Auxiliary Engineer Corps. A bill for this purpose was recently placed in the hands of Senator Joseph E. Ransdell, with a view to having it introduced by request at the coming session of Congress. This bill provides for a complete organization from top to bottom—non-combative with a military status and under the direction of the Chief of Engineers, U. S. A., with the rank he now has, major general, and the division engineers with the rank of brigadier general, and the district engineers with rank of colonel; with provision for ranks for assistants below the district engineer. The corps is to be mobilized from the *experienced* men of *all* classes in the office and field now in the service. Its duties are as now—construction, care of maintenance of public works; and national highways and bridges to be added. Let us talk about national good roads; absolutely necessary for the welfare and prosperity of the nation.

2. The foundation of this organization rests solely upon merit, in which the lowest paid man, if he is made of the right stuff, has a chance to make something of himself. It is not a salary grab, nor does it provide any fat jobs.

3. It provides for a three-year practical training period for all who enter the service and who have had no previous engineer experience, before a man can get into the permanent corps, unless he qualifies for a commission before that time.

4. It provides graded pay in the various classes of the personnel, and also longevity pay of 5% increase for every three years' service, for eight 3-year periods; besides the opportunity, if qualifications justify it, for promotion from class to class with higher pay in such class. It provides also for an efficiency board that shall pass upon the qualifications of the personnel, so that justice is done to all men; with reference to duties performed and rank and compensation, which any member of the corps is justly entitled to. I may perform the same duties as junior engineer which you perform as inspector. The inequality of grade and pay is apparent.

5. As the honor men of West Point furnish the personnel for the Army engineers, so shall the honor men of our schools and colleges furnish the personnel of all departments of office and field service, for the Auxiliary Engineer Corps, through the three-year training period.

6. The district engineer is the commanding officer of the district, and the contracting officer, with division of duties under several departments each in charge of experienced assistants under him.

7. The duties of custodian of property and disbursing officer will be divorced from the duties of district engineer, leaving the hands of the latter untied for strictly engineering duties. No corporation would think of merging the duties of chief engineer with that of treasurer or paymaster.

8. Now then—it is essential to watch progress at Washington. Essential to have the bill introduced in the coming session, and essential to keep it going till passed.

9. *When you hear* that the bill is introduced, call on your Congressman or Senator for printed copy.

10. Talk for such legislation—be enthusiastic over it—get your business friends to write letters requesting the passage of the bill. Keep at it and don't let it rest. It will take time to get the bill through.

11. It may be necessary to keep a man in Washington under pay to *"mark time"* and keep a sharp lookout. All the engineering district, I feel sure, will rally to the necessary financial assistance.

12. If you are really interested, send a self-addressed envelope, 3½ in. x 9 in. with 3c. postage stamp affixed, for copy of "Reasons Why an Auxiliary Engineer Corps Should be Mobilized at This Time." Any further "dope" desired will be furnished, but always send self-addressed stamped envelope.

13. Later on, if you desire it, we will have the bill cyclostyled. This work, with a copy of the brief mailed flat, will cost about 15c. for postage and paper.

14. It is desired to work and talk quietly among the employees and our friends in each district—though the New Orleans *Times-Picayune* recently published something about the proposed legislation. I feel sure the district engineers do not care to have anything to do with this legislation one way or another. They are trained to do their duty and not be relieved from it. If things have gotten into a deep rut, any relief needed must come through the people and Congress; so it is up to us to take the initiative. Strong influence is working to turn public works over to the Quartermaster Corps because they have already so many of our men in the service, and there is talk of a waterways commission and a construction engineer branch in the Quartermaster's service; but it is not believed that either the people or Congress are ready for a change of engineers. The Auxiliary Engineer Corps will meet any public necessity if there is one, for a waterways commission. There is a chance for any engineer that knows anything about river and harbor work to get in, as it calls for men having this special qualification, and where he will have every opportunity to make use of it. Let us work for it. Personal work among ourselves and friends, and before Congress, will be of much value.

Address, John D. Schmidt, 519 Canal St., New Orleans, La.

National Service Committee Makes Report of Activities

At the recent regular meeting of Engineering Council, the National Service Committee reported that since the Chicago conference on a national Department of Public Works held last April (see *Engineering News-Record* of May 1, 1919, p. 857) the work has been divided into four parts: (1) Organization of executive and finance committees; (2) drafting of a bill; (3) organization of a campaign committee, and (4) a review of public-works laws of other countries.

The Chicago conference appointed an executive committee, including Cass Gilbert, Morton C. Tuttle and W. O. Winston, who declined appointment; their places were filled by J. Parke Channing and W. H. Hoyt, of Duluth, and the National Lumber Manufacturers' Association is to name a member. The committee on text of bill has completed its labors, and it is the intention to consult leaders in Congress and obtain advice as to its introduction.

The campaign committee is still in process of organization, the desire being to obtain one or more members from each state in the Union. It was determined to create separate state committees, all synchronizing with the Washington office.

The review and compilation of the public-works laws of other countries are practically completed.

To coöperate with the state campaign committees and supply them with information and talking points, it is proposed to obtain a man with expert knowledge of Government procedure. The engagement of a publicity man is also proposed. The committee desires to conduct the campaign by avoiding objectionable methods of the past, and substitute therefor a campaign, conducted on a high and dignified plane, consisting largely of counsel given to members of Congress by their constituents—thoughtful, serious advice given in an individual capacity in much the same way in which an engineer or architect would advise a client.

In order to introduce Engineering Council to members of Congress and make known its purposes, a letter was addressed to the chairmen of various committees of the House and Senate. Appreciative acknowledgments have been received from a large number.

A regular monthly bulletin is now issued. It aims to cover the most important Governmental engineering work, the last one being a list of all engineering legislation which has been introduced into the 66th Congress and a brief discussion of the most important measures included therein.

Civil Service Examinations

United States

For United States civil service examinations, listed below, apply to the United States Civil Service Commission, Washington, D. C., or to any local office of the commission, for form 1312.

Assistant designing engineer, Naval Ordnance Plant, South Charleston, W. Va., $9.20 per diem. July 8. File applications before July 8.

Valuation engineer, $3600-$4800 per year, and assistant valuation engineer, $2500-$3600 per year; technical staff, income-tax unit, Bureau of Internal Revenue, Treasury Department. No date specified.

Master computer, $2400 to $1800 per year, computer (Grade I) $1800 to $1400 and computer (Grade II) $1400 to $900, Ordnance Department. Applications will be received until further notice.

Assistant inspector of engineering material (aircraft), $5.92 per diem, July 15. File applications before July 15.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN SOCIETY FOR TESTING MATERIALS; University of Pennsylvania, Philadelphia; June 24-27, Atlantic City, N. J.

AMERICAN CONCRETE INSTITUTE; 6 Beacon St., Boston; June 27-28, Atlantic City, N. J.

NEW ENGLAND WATER WORKS ASSOCIATION; Tremont Temple, Boston; Sept. 30, Oct. 1-3, Albany, N. Y.

The Engineers' Society of Milwaukee held its regular monthly meeting, June 11. It was addressed by G. G. Curtis, of the Bray Studios, Inc., New York City, who showed and described the films, "The Motion Picture's Secret Part in Winning the War" and "The Motion Picture of the Invisible," illustrating gasoline vapor, sound waves, electric current and other unseen forces.

The Western Society of Engineers was addressed June 9 by J. H. Waterman, superintendent of timber preservation, Chicago, Burlington & Quincy R.R., who spoke on "Results Obtained from Treatment of Track, Ties and

Bridge Timbers." The celebration of the society's 50th anniversary has been postponed until June 27-28. The first day's program will include the topics, "Fifty Years of Engineering Progress" and "The Engineer in War." On the second day there will be a basket picnic at the sand dunes on the south shore of Lake Michigan.

The West Virginia Engineers' Association was tentatively formed at a meeting held in Charleston June 8, at which a constitution and by-laws were adopted. No officers were elected at the organizing meeting.

The New England Water Works Association and the Boston Society of Civil Engineers will hold a joint field day at Pemberton, Mass., June 25, with dinner at the Pemberton Inn. The boat will leave Rowe's Wharf, Boston, for Pemberton at 10:15 a. m.

The New York Chapter of the American Association of Engineers was addressed June 11 by Maj. David A. L'Esperance, who spoke on "The History of the 15th New York Regiment." the meeting was also addressed by A. H. Krom.

The Engineering Society of Akron, Ohio, held its first annual banquet June 10, at which E. E. Workman, president of the Akron Chamber of Commerce, spoke on the proposed city plan for Akron.

The Louisiana Engineering Society was addressed June 9 by Thomas L. Willis, city engineer of New Orleans, who spoke on garbage disposal, with particular reference to conditions in New Orleans.

The Montreal Branch of the Engineering Institute of Canada gave a dinner to Brig. Gen. Charles H. Mitchell, C.M.G., D.S.O., June 12, on the occasion of his return from overseas. General Mitchell gave an account of his experience and the part played by the engineering branch of the service on the other side of the ocean in winning the war.

PERSONAL NOTES

FRANCIS C. SHENEHON and ADOLPH F. MEYER have become associated under the firm name of SHENEHON & MEYER, consulting and designing engineers, with offices in the Metropolitan Bank Building, Minneapolis. Mr. Meyer enters the new firm from his work as special lecturer on hydraulic engineering at the University of Minnesota, having very recently served also as chief engineer and general superintendent of pulp and paper mills, Minnesota & Ontario Paper Co. He is a graduate in civil engineering, Wisconsin University, class of 1904, and has been engaged in engineering work, more particularly in the field of hydraulic engineering, since that date. From 1914 to 1917 he served as associate professor of hydraulic engineering, University of Minnesota, at the time when Mr. Shenehon was dean of the college. Since that time Mr. Shenehon has been engaged in a variety of work, in private practice, specializing largely in hydraulic engineering.

LIEUT. COL. DABNEY H. MAURY, Construction Division, U. S. A., who was advisory engineer for the original construction of water-supplies in the Army, and who recently received his discharge from the service, is in Chicago arranging for temporary consulting-office quarters. Several Eastern engagements prevent his resuming his former practice in Chicago for the time being, and he is at present making his headquarters at the University Club. Colonel Maury states that the advisory engineer's office handled 275 different projects, supplying 4,000,000 troops and 2,000,000 civilians. No typhoid fever has been attributed to the water furnished.

W. E. HART has been appointed district engineer in charge of the Minneapolis office of the Portland Cement Association, handling work in Minnesota and North and South Dakota. He has been connected with the association for the past two years, his work being principally in South Dakota. He was previously county engineer of Eddy County, North Dakota, and city engineer of New Rockford, North Dakota.

CAPT. LEVANT BROWN, Engineers, U. S. A., has received his discharge from the service and has become associated with the San Francisco office of the United States Bureau of Public Roads, as senior highway engineer. Captain Brown was with the Bureau of Public Works in the Philippines as a constructing engineer for ten years, before entering Army Service.

MAJ. SAMUEL W. FLEMING, JR., a member of the firm of GANNETT, SEELYE & FLEMING, of Harrisburg and Erie, Penn., who recently returned to this country from overseas, expects to receive his discharge at an early date. Major Fleming served with the 315th Infantry, and has been decorated with the Croix de Guerre and the Distinguished Service Cross.

PROF. CHARLES J. TILDEN, head of the department of civil engineering, Johns Hopkins University, has been called to the Sheffield Scientific School of Yale University as head of the department of engineering mechanics, and will begin his duties in that position next September. Professor Tilden has served for nearly six years as head of the department of civil engineering at Johns Hopkins. In February, 1917, he received his commission as a captain in the Engineer Officers' Reserve Corps and was ordered to active duty, but later returned to the inactive list to become secretary of the general engineering section, advisory committee, Council of National Defense. In May, 1918, he was appointed to the department of education and training, United States Shipping Board, Emergency Fleet Corporation, and was in charge of education and training work in Districts Nos. 8 and 11 on the Pacific coast. He returned to Johns Hopkins University in October last year.

LIEUT. COL. W. G. ARN, Engineers, U. S. A., recently received his discharge from the service, and has resumed his former work as assistant engineer, maintenance of way, Illinois Central-Yazoo and Mississippi Railroad System, with headquarters in Chicago. Colonel Arns entered the service on February, 1917, as captain in the Engineer Officers' Reserve Corps, and was called to active service in May and assigned to the 13th (Railway) Engineers. In March he was promoted to major, and in April, 1919, to lieutenant colonel of the same regiment. While in France he was located in the Verdun sector from September, 1917, to March, 1919, in charge of maintenance and construction work.

C. R. CUMMINS and N. F. BLAIR have become associated under the name of the CUMMINS-BLAIR CO., which will be affiliated with the present C. R. Cummins Co., with offices in the Leader-News Building, Cleveland. The new company will engage in reinforced-concrete and brick building construction.

LIEUT. COL. HAROLD TROTTER, D. S. O., has returned to Canada after several years' service at the front. Before the war he was a member of the firm of HENRY HOLGATE, consulting engineers, Montreal. He entered the war as a captain in the Canadian Engineers.

C. E. SHEARER, who for the past year has been engaged in bridge engineering for the Government of the Philippine Islands, has returned to his office in Memphis to resume private practice.

LIEUT. COL. GEORGE A. JOHNSON and MAJ. WEBSTER L. BENHAM, whose association in partnership under the firm name of JOHNSON & BENHAM was recently announced in these columns, have offices in the Firestone Building in Kansas City, Mo., and not in the Pathfinder Building, as previously stated. Colonel Johnson entered the service originally as officer in charge of the water and sewer section of the maintenance and repair branch of the Construction Division. Original construction of water supplies from the first was handled by LIEUT. COL. DABNEY H. MAURY, advisory engineer for water-supply of the Construction Division of the Army.

LIEUT. W. L. RHULE, Quartermaster Corps, U. S. A., who recently received his discharge from the service, has become associated with his father, George M. Rhule, in building construction, with headquarters in Altoona, Penn.

M. C. HUTCHINS, engineering department, Southern Railway, has been elected city engineer of Charlotte, N. C., succeeding J. C. CALDWELL, who has resigned to enter the contracting business of Caldwell, Thompson & Company.

JAMES A. SALTER has been appointed state architect of North Carolina, the appointment being authorized by the State Building Commission through act of the legislature creating the office.

L. J. DRIGGS, construction engineer, Pennsylvania Public Service Co., at Phillipsburg, has been appointed construction engineer, Citizens' Light, Heat & Power Co., of Johnstown.

FRANK T. SHEETS has been appointed designing engineer, Illinois Division of Highways, with complete charge of the design, preparation of plans and surveys of all roads and bridges constructed by the state.

CAPT. OMAR GASTON, Construction Division, U. S. A., who recently received his discharge from the service, has become general superintendent of building construction, Dahlman Construction Co., Milwaukee.

MANLEY OSGOOD, assistant plant engineer, Merchant Shipbuilding Corporation, Harriman, Penn., has been appointed chief engineer, Detroit Bureau of Governmental Research, with office at 100 Griswold Street.

MAJ. HERMAN F. DOELEMAN, Construction Division, U. S. A., has received his discharge from the service and has resumed his practice as a consulting engineer, with offices at 507 N. Charles St., Baltimore.

CAPT. JOHN K. WILLIAMS, Engineer Corps, American Expeditionary Forces, has received his discharge from the service and has accepted a position in the city engineer's department in San Diego, Calif.

J. H. BARNES and JOHN R. LESLIE have become associated under the firm name of the LESLIE-BARNES ENGINEERING CO., St. Joseph, Mo. Mr. Barnes has resigned as engineer of the city park board to devote his entire time to the new company.

LIEUT. JAMES FERGUSON has returned to Canada after four years' service overseas and has resumed his work in the engineering department of the Canadian National R.R., with headquarters in Montreal.

B. HAROLD WILLS has received his discharge from the Army and has returned to his former work in the engineer's office of Burlington County, at Mount Holly, N. J.

MAJ. D. D. GUILFOIL, 108th Engineers, U. S. A., who recently returned from France, has received his discharge from the service and has returned to his former work as sales engineer, SAUERMAN BROS., engineers and manufacturers, Monadnock Block, Chicago. The 108th Engineers, composed mainly of Chicago men, participated in the Somme and Meuse-Argonne offensives and, following the armistice, was a part of the army of occupation in Luxembourg.

L. R. WOODHULL has been appointed engineer, State Building Commission of North Carolina.

MAJ. E. J. COE has been appointed city engineer of Duluth, Minn., succeeding COL. LIONEL AYERS, resigned.

NILES C. SORENSEN, structural engineer and architect, has opened offices at 500 Congress Building, Detroit, for the practice of architecture and architectural engineering.

ARTHUR G. SKOUGLAND has been appointed engineer of the park board of St. Joseph, Mo., succeeding J. H. BARNES, resigned to enter private practice, as noted elsewhere.

G. W. COMSTOCK has been appointed county road engineer of Wetzel County, West Virginia, with headquarters at New Martinsville.

WILLIAM E. MITCHELL, 305th Engineers, has returned to Altoona, Penn., and will soon leave for Duluth to supervise construction work for R. C. Woods & Co., Camden, N. J.

T. H. JOY and H. E. GALLUP have announced the dissolution of the firm, the JOY-GALLUP CO., engineers and architects, Birmingham, Ala.

Asphalt Association Formed

Representatives of several asphalt-producing companies of the United States and Canada have completed the organization of an association, the title of which is to be "The Asphalt Association." Its purpose will be to disseminate information on the uses of asphalt, with particular reference to highway and street paving, coöperation with city, county and municipal officials and with scientific bodies and colleges seeking to bring about the most effective methods for the use of the material. The New York office will be located at 15 Maiden Lane. Other offices will be established soon in Chicago and Atlanta, and ultimately in other cities in the United States and Canada.

The following officers were elected for the ensuing year: President, J. R. Draney, general sales manager of the United States Asphalt Refining Co.; vice-president, W. W. MacFarland, assistant secretary of the Warner Quinlan Company; treasurer, N. G. Luykx, of the Freeport & Mexican Fuel Oil Corporation; secretary, J. E. Pennybacker, formerly chief of management of the United States Bureau of Public Roads, during the war period secretary of the United States Highways Council, and, more recently, director of roads of the American Automobile Association. Mr. Pennybacker will be the active officer in charge of the affairs of the association.

Exhibits Numerous and Varied at Water-Works Convention

Activity in the water-works field of engineering is indicated by the unusually large number of exhibits at the recent annual convention of the American Water Works Association in Buffalo, N. Y. The exhibits themselves were quite varied in character, covering practically every detail of apparatus, process and literature pertaining to the field. On account of the unexpected number of exhibitors, it was necessary to provide overflow exhibition rooms to accommodate them. The names of the companies which were represented are as follows:

National Water Main Cleaning Co.
Rensselaer Valve Co.
Pittsburgh Meter Co.
Engineering News-Record
The A. P. Smith Manufacturing Co.
Wallace & Tiernan Co., Inc.
The American City
Builders' Iron Foundry
Thomson Meter Co.
Gamon Meter Co.
Fire and Water Engineering
Lock Joint Pipe Co.
Municipal Journal and Public Works
Engineering and Contracting
Eddy Valve Co.
Buffalo Meter Co.
The Pitometer Co.
United Brass Manufacturing Co.
The Central Foundry Co.
Glauber Brass Manufacturing Co.
United Lead Co.
E. I. du Pont de Nemours & Co.
Union Water Meter Co.
Hays Manufacturing Co.
Pittsburgh-Des Moines Steel Co.
Birch-Hintz Manufacturing Co.
Lead Lined Iron Pipe Co.
Electro Bleaching Gas Co.
Modern Iron Works
Joseph Dixon Crucible Co.
W. & L. E. Gurley
Worthington Pump & Machinery Corporation
N. Mueller Manufacturing Co.
The Kennedy Valve Manufacturing Co.
Pittsburg Filter & Engineering Co.
Neptune Meter Co.
Water Works Equipment Co.
Ford Meter Box Co.
Multiplex Manufacturing Co.
Chicago Bridge & Iron Works
New York Continental Jewell Filtration Co.
Canadian Engineer
The Leadite Co.
H. W. Clark Co.
Hersey Manufacturing Co.
Sullivan Machinery Co.
Ross Valve Manufacturing Co.
Hauck Manufacturing Co.
The Garlock Packing Co.
McNutt Meter Box Co.
Bingham & Taylor
Simplex Valve & Meter Co.
Pennsylvania Salt Manufacturing Co.
National Meter Co.
Flower Valve Manufacturing Co.
Allis-Chalmers Manufacturing Co.
United States Cast Iron Pipe & Foundry Co.
Arnold-Hoffman Co., Inc.
El Ingeniero y Contratista
United States Rubber Co., Mechanical Goods Division
American Manganese Bronze Co.
Irving Iron Works Co.
Badger Meter Manufacturing Co.
Carbic Manufacturing Co.
Flexible Armored Hose Corporation
Darling Valve & Manufacturing Co.
Richardson Phoenix Co.
International Filter Co.
John Fox
Roberts Filter Manufacturing Co.
American Steel & Wire Co.
De Laval Steam Turbine Co.

Impostor Soliciting Loans

The Thomson Meter Co. issues a warning that an impostor is traveling through the New England States representing himself as a relative of a former officer of that company, and soliciting loans to pay hotel bills, railroad fare, etc. If he should call upon the reader, the company requests that

he be held on suspicion, wiring immediately to E. M. Shedd, 266 Brookline Ave., Boston, Mass., or the Thomson Meter Co., 100 Bridge St., Brooklyn, N. Y.

Government Surplus Materials To Be Sold in Seven Classes

Under arrangements made after the signing of the armistice to dispose of Government surplus materials with the least disturbance of normal business conditions, the director of sales, C. W. Hare, assisted by a score of assistants, has classified under seven sections the materials to be disposed of. Each section is supervised by assistants chosen because of their previous familiarity with the commodities over which they have charge. These materials include those which had been contracted for previous to the armistice and which the Government was forced to take over when the signing of the armistice practically suspended operations in over 500 manufacturing plants throughout the country. Practically all these plants were turning out, as component parts or finished products, materials foreign to their peace-time production.

The various sections which will handle the materials as classified are as follows: (1) Contractors' and railway equipment and building material; (2) plant facilities, including completed and uncompleted manufacturing plants, warehouses, etc.; (3) machine tools; (4) motor vehicles, vehicles, and aircraft; (5) quartermaster stores; (6) ordnance and ordnance stores; (7) raw materials and scrap.

The actual selling of the surplus materials is to be done by the several bureaus of the War Department which holds title to the property to be disposed of. Sales will be made under the following rules: (1) For cash at auction; (2) to the highest bidder on sealed proposals; (3) at the current market price if there is an established market for such property and current market quotations accompany the report of sales; (4) by negotiations under competitive conditions and provided the price obtained is not less than the price fixed by appraisal, or is the highest of not less than three independent competitive bids.

Material-Handling Machinery Manufacturers Meet

Four sessions of a semi-annual meeting of the Material-Handling Machinery Manufacturers' Association were held June 10-11 at the Hotel Astor in New York City, with a large membership in attendance. Most of the time was given over to discussions of proposed publicity methods by which the attention of engineers and manufacturers could be brought to the advantages and economies of machinery instead of hand labor for handling all kinds of material, but an evening session was devoted to more general subjects, with special attention to machinery used in ports and terminals.

Business Notes

THE BARBER ASPHALT PAVING CO., of Philadelphia, announces that, following the promotion of Charles W. Bayliss from manager of the street and road department to vice-president in charge of sales, the following changes in organization have become effective: J. E. Morris is appointed manager of the street and road department, Philadelphia, Penn.; H. M. Stafford succeeds Mr. Morris as assistant manager in charge of the Eastern district, with headquarters in Philadelphia; F. F. Massey succeeds Mr. Stafford as assistant manager in charge of the Southwestern district, with headquarters in Memphis, Tenn., and G. R. March succeeds T. H. Morris as sales manager of the Iroquois department.

THE WILLIAM B. SCAIFE & SONS CO., of Pittsburgh, Penn., manufacturer of steel buildings and bridges, transmission towers, and storage tanks for oil and water, announces the opening, July 1, of a Chicago sales and engineering office at 38 S. Dearborn St. Charles F. O'Hagan, formerly chief engineer of the company at Pittsburgh, will be resident engineer and manager.

THE BAILEY METER CO., of Cleveland, Ohio, announces that E. A. Hitchcock has become associated with the company as vice-president. He will supervise the training of technical graduates for the company's service and sales department. For the past six years he has been connected with the E. W. Clark & Co. Management Corporation in an advisory capacity. Previous to that time he was professor of experimental engineering at the Ohio State University.

THE BORDEN CO., of Warren, Ohio, manufacturers of Beaver easy-working die-stocks and square-end pipe cutters, announces that C. A. Greene, its Chicago representative, has opened a downtown office at 549 W. Washington Boulevard.

THE CHICAGO PNEUMATIC TOOL CO, Fisher Building, Chicago, Ill., announces that J. W. McCabe, who was district sales manager of the company at Buffalo, N. Y., has been appointed special representative for the foreign-trade department. The company announces also that W. H. White has been appointed acting district manager of sales at Buffalo during Mr. McCabe's absence on a trip to the Orient.

THE CHALMERS PUMP MANUFACTURING CO., of Lima, Ohio, announces that it has purchased the entire pumping machinery business of the Canton-Hughes Pump Co., of Wooster, Ohio. Beside C. F. Brown, president, and Fred Biszantz, secretary and treasurer, of the old Chalmers Pump & Manufacturing Co., Frank D. Shumate, of Chicago, has become associated with the company as vice-president and sales manager. Mr. Shumate has been connected with the Worthington Pump & Machinery Corporation for the past 13 years.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING CO. announces the appointment of H. L. Garbutt, for the past six years manager of the line-material section of the company at East Pittsburgh, Penn., as manager of the supply division of the San Francisco office. Mr. Garbutt was formerly in the sales organization of the Drew Electric & Manufacturing Co., of Indianapolis.

THE MACOMBER & WHYTE ROPE CO., Kenosha, Wis., has opened a branch at 30 Church St., New York City, under the management of E. E. Robirds; also a branch at Birmingham, Ala., in charge of James A. Boope, 805 American Trust Bank Building.

Trade Publications

The following companies have issued trade publications:

THE AMERICAN DISTRICT STEAM CO., of North Tonawanda, N. Y.; catalog, 80 pages, illustrated; descriptive of central-station and interior heating equipment. Also a folder entitled "The Radiator Has the Floor," describing the "Adsco" vapor heating system.

THE HODGES STUCCO MACHINE WORKS, of Union Central Tower, Cincinnati, Ohio; pamphlet, 9 x 12 in., eight pages, illustrated; describes the Hodges electric stucco machine for applying stucco by centrifugal action.

THE WALLACE & TIERNAN CO., INC., of 349 Broadway, New York City; folder, 8½ x 11 in., 4 pages; states the necessity for sterilization of water supplies affected by spring rains and floods and advocates the use of liquid chlorine as the agent.

THE M. & M. WIRE CLAMP CO., 2 Fifth St., S. E., Minneapolis, Minn.; pamphlet, 3½ x 6 in., 15 pages, illustrated; describes the use of adjustable concrete form clamps.

THE CENTRAL FOUNDRY CO., of 90 West St., New York City; leaflet, 8 x 6 in., one page, illustrated; describes the use of "Led-Lok" for the connection of cast-iron soil pipe, consisting of a lead joint which is locked into the pipe.

THE HOOD MANUFACTURING CO., of 3227 First Ave., South, Seattle, Wash.; catalog, 7 x 10 in., 16 pages, illustrated; gives specifications for and illustrates the use of Hood tractors.

THE MCMYLER INTERSTATE CO., of Cleveland, Ohio; bulletin No. 40, 8½ x 11 in., 49 pages, illustrated; describes and gives layouts for the use of shipbuilding cranes.